

AFFECTED ENVIRONMENT



NATURAL RESOURCES

AIR QUALITY AND VISIBILITY

The Mojave Desert Air Quality Management District (MDAQMD) manages and enforces the Clean Air Act's air quality standards in the Mojave National Preserve. The district includes the desert portion of San Bernardino County.

Congress established the Prevention of Significant Deterioration program as part of the Clean Air Act. To facilitate the implementation of this program, an area classification scheme was established. This classification scheme has class I receiving the highest degree of protection with only small amounts of certain kinds of additional air pollution (sulfur dioxide and particulate matter) allowed. The other two areas are class II, which allows moderate increases in certain air pollutants; and class III, which allows a large amount of new air pollution (Congress has yet to designate any class III areas). There are no class I areas in the California Mojave Desert. Mojave National Preserve is a class II "floor" area, meaning that it may never be redesignated to class III.

FEDERAL AND STATE NONATTAINMENT AREAS

The Clean Air Act developed national ambient air quality standards for a finite number of pollutants called "criteria pollutants." The criteria pollutants are: sulfur dioxide, carbon monoxide, total suspended particulates, nitrogen oxides, lead, ozone, and particulate matter less than 10 microns in diameter (PM₁₀). State of California standards, which are stricter than federal standards, include additional standards for hydrogen sulfide and particulate sulfates.

The Environmental Protection Agency has classified the Mojave National Preserve as a nonattainment area for ozone and PM₁₀ standards. Nonattainment areas are areas that are not in compliance with the National Ambient Air Quality Standards, and therefore must reduce pollution to reach compliance. Nonattainment requirements include reasonable controls on existing stationary sources, most stringent controls on new sources, emission offsets, transportation control plans (including inspection and maintenance), and sanctions for failing to submit a plan.

POLLUTION SOURCES

Visibility is probably the most important air quality resource in the desert region, and it is the most easily affected by activities that generate dust (especially fine particulates) and sulfur dioxide. Visibility impacts occur from long-range transport of pollutants from as far away as the San Joaquin Valley and the Los Angeles basin (RESOLVE study 1988, cited in BLM 1995).

Nearby sources of emissions include the Army's National Training Center at Fort Irwin; Viceroy Mine near Searchlight, Nevada; the Mojave Generation Station near Laughlin, Nevada; MolyCorp Mine and Stateline Power Generation Station near Primm (Stateline), Nevada; and vehicle traffic on Interstates 15 and 40.

Local pollution sources in the desert consist primarily of particulate matter from off-road vehicles, windblown soil, mining operations, livestock grazing, and agricultural activities. These sources have left certain areas denuded or sparsely vegetated, allowing wind erosion to occur and air quality to suffer and occasionally causing violations of particulate standards at many locations.

NIGHT SKY

The night sky of Mojave National Preserve is dark and offers visitors the chance to enjoy stargazing mostly untainted by artificial light reflection. However, the northern and southern boundaries are interstate highways. Traffic on these highways and the lights from Baker, Primm, and Laughlin are beginning to have a noticeable adverse effect on the night sky.

NOISE

Vehicle noise can be heard in the planning area. For example, the Kelbaker, Kelso-Cima, Morning Star, Ivanpah Roads in the Mojave National Preserve are connectors with I-15 and I-40. About 8,000-11,000 vehicles use these north-south connector roads each month. It is believed that many people using these roads are California residents living south of the preserve (for example, Palm Springs and Twentynine Palms) who use the preserve roads as a short cut to Las Vegas and other areas outside California. The I-15 (north of the Yermo Inspection Station to the Stateline) average daily traffic is between 26,000 and 35,000 vehicles (CalTrans, 1996). Peak northbound traffic along this stretch occurs on holiday eves or Fridays; peak southbound traffic occurs on Sundays.

Vehicle noise is generally not an issue within the preserve in spite of the many and heavily used roads (I-15 I-40, and NPS major paved roads). Because of the preserve's vastness, most areas are well away from traffic and its noise.

Other areas where localized noise occurs are at the Razor Open Area, adjacent to the western boundary of the preserve, the Union Pacific and Santa Fe rail lines, and mining operations.

OVERFLIGHTS

The preserve is within 100 miles of five U.S. Department of Defense facilities having air operations: Fort Irwin Military Reservation, U.S. Naval Weapons Center, China Lake, Marine Corps Air-Ground Combat Center, and Air Force Bases at Edwards and Nellis.

Military aircraft from these facilities occasionally use preserve airspace. Although aircraft noise does not appear to affect wildlife, visitors to the area often react adversely to jet noise and sonic booms. In addition, some booms have caused damage to natural and cultural resources (NPS 1988).

Parts of the preserve are within a joint service restricted airspace complex designated as a military operations area (R2508) that permits aircraft to fly at speeds exceeding 250 knots and at altitudes 200 feet above ground level or higher (DOD 1995). The military operations area is used on a daily basis by Navy and Air Force aircraft. Low-level overflights of various military aircraft are occasionally observed in the preserve.

Title VIII of the California Desert Protection Act, 1994, contains the following provision:

Nothing in this Act, the Wilderness Act, or other land management laws generally applicable to the new units of the National Park or Wilderness Preservation Systems (or any additions to existing units) designated by this Act, shall restrict or preclude low-level overflights of military aircraft over such units, including military overflights that can be seen or heard within such units.

WATER RESOURCES

GROUNDWATER

Groundwater is found underneath most of the preserve and varies greatly in depth and quality. The Mojave River is the primary subsurface water source for the preserve (BLM 1996). The many groundwater basins in the preserve are recharged from surface and subsurface infiltration. Depletion of groundwater basins and diminishing water quality are concerns that were expressed at public meetings. Groundwater is the preserve's principal source for desert springs, seeps, and a few ephemeral streams, and its only perennial spring, Piute Creek. The maintenance of groundwater quality and quantity is critical to the survival of desert surface waters and their associated plant and animal life.

There are two major areas of concern for Ivanpah Dry Lake. One is groundwater depletion, as the water is being used to maintain three golf courses and to supply MolyCorp's mining operation at Mountain Pass. Water levels in the Ivanpah Dry Lake basin have declined an average of about 2 feet per year for the past 50 years (MolyCorp 1996). This depletion did not include the golf courses that were completed in 1996. MolyCorp is also proposing to enlarge its mining operations, including a substantial dewatering of new mine pits. This dewatering could cause the springs to go dry in the Clark Mountain segment of the preserve. The other concern is the contamination of Ivanpah Dry Lake's surface and groundwater from MolyCorp's legal and illegal mine waste discharges.

Another site near the preserve where the rate of groundwater use appears to exceed normal groundwater recharge is the Castle Mountain Mining Project Viceroy Gold Mine, which is adjacent to the preserve's eastern boundary. At Castle Mountain the average groundwater withdrawal has been over 400-acre feet per year since 1996 (BLM 1997). This mining

operation has proposed to continue mining for another 10 years past its present operation, until about 2010 (BLM 1997). Well data has shown a continued drop in water levels, indicating that the withdrawals exceed groundwater recharge.

OTHER WATER SOURCES

The small springs and seeps in the preserve offer isolated and limited water for plants, wildlife, or domestic or commercial purposes. Some springs produce potable water, but overall water quality is poor because of high dissolved mineral concentrations (BLM 1996). Over 200 springs and seeps have been identified in the preserve (King and Casebier 1981). Many, if not most, have been altered by the installation of retention dams, pipelines, and troughs for livestock use. Most are also available for wildlife and burro use. In the eastern portion of the preserve is a 1-mile perennial stream called Piute Creek. Recorded spring outlet flows (measured monthly since June 1988) have ranged from 21 gallons per minute (gpm) in November 1991 to 58 gpm in December 1993. The average over this time was 42 gpm (Viceroy Gold, 1997). This stream, only perennial stream in the preserve, is an important wildlife water source as well as a popular recreation site.

Some people have said that historic and present mining and cattle ranching have resulted in less water for wildlife consumption being available now than was available about 220 years ago, when the first Europeans entered the Mojave Desert. The literature offers no evidence to support these claims; rather, it indicates that there may be more water now. Accounts from the late 18th and early 19th centuries by Garces and Jedediah Smith and from surveys conducted by Thompson for the USGS in the early 20th century indicate that water holes were few and far between. The number of springs and seeps that are now known is far greater than the early inventories recorded by Thompson. With the addition of wells and guzzlers, it may seem that there is more water now than in the past.

Water wells have been drilled primarily for domestic use and livestock needs, but a number of wells have also been drilled for mining use. Viceroy Gold Mine has developed a well field that is adjacent to and within the preserve. This well field is within a 9-square mile area located northwest of the mining site. Viceroy is permitted to pump 725 acre-feet per year, but it has been averaging about 400 acre-feet (about 11 million gallons per month) since 1995 (BLM 1997).

Water wells have been drilled specifically for visitor and administration use at the Mid Hills campground and Hole-in-the-Wall campgrounds.

WATER RIGHTS

Initial research on outstanding water rights in the preserve at the State Water Resources Control Board in Sacramento revealed that there are approximately 110 appropriated water rights claims on 97 water sources (springs, seeps, streams, wells) in the preserve. Many of

these were obtained by ranchers who lease grazing allotments. See attached Land Protection Plan in Appendix C for a complete list.

VEGETATION AND WILDLIFE

EXOTIC SPECIES

Exotic species can include both plants and animals. They are generally defined as those species that occur in a given place as a result of direct or indirect, deliberate or accidental actions by humans. The exotic species introduced because of such human action would not have evolved with the species native to the place in question and therefore would not be a natural component of the ecological system characteristic of that place. Examples of exotic species in the preserve are wildlife such as burros and chukar and plants like tamarisk and Russian thistle.

Vegetation

Tamarisk, Russian thistle, and introduced annual grasses (from Europe and Asia) are some of the more pernicious exotics within the Mojave National Preserve. These species often out-compete native vegetation, subsequently eliminating or displacing natives and associated native animals. Annual plants such as introduced grasses and Russian thistle often cause an unnatural increase in the amount of dried material available as wildfire fuel.

The tamarisk (*Tamarix ramossissima*) or salt cedar, an introduced shrub or small tree 5 to 20 feet tall, is an opportunistic invader of moist areas. Both the Bureau of Land Management and the National Park Service have ongoing control programs that are attempting to manage this invasive plant. Continuing control is needed to prevent this weedy tree from outcompeting and eliminating native vegetation. A larger, less invasive relative, the athel (*T. Aphylla*), has been planted (typically as a windbreak or sand-break) in a number of locations in the preserve (e.g., near Kelso Depot).

Russian thistle (commonly called tumbleweed) is common in many disturbed areas in Mojave National Preserve, such as at old mining sites and along roadsides.

Introduced annual grasses such as *Bromus* and *Schismus* species are serious pests when mature (Hitchcock and Chase 1971). “The narrow, sharp-pointed minutely barbed florets (or fruits) with their long rough awns work into the eyes, nostrils, and mouths of stock, causing inflammation and offer serious injury” (Hitchcock and Chase 1971). The increase of these grasses throughout much of the arid west is believed to be an important contributing factor in the increase in desert wildfires, which were uncommon at one time.

Animals

Chukar. The Chukar (*Alectoris graeca*), an upland game bird popular among hunters, was first introduced into California (from India) in 1932 (Mallette c.1970). Between 1932 and

1955, more than 52,000 birds were released by the California Department of Fish and Game (Mallette c.1970). The birds prefer rocky open hills and flats. Sightings have been reported from below sea level to above 12,000 feet in the White Mountains and Sierra Nevada. The animal is abundant in parts of the preserve.

Rocky Mountain Mule Deer. The California Department of Fish and Game introduced the Rocky Mountain mule deer (*Odocoileus hemionus hemionus*) into the New York and Providence Mountains of the preserve in February and March of 1948 from Arizona (Dasmann 1968 and Burke 1997). Nine bucks and 31 does were released. The first authorized hunt of this population was in 1955. The department estimates that about 25 deer are taken per year (Burke 1997). The population has remained relatively stable since the first introduction. Tag returns for buck kills in Northeastern San Bernardino County were 18 animals (see table 8).

Burros. Burros were used little on the Southwest between 1530s, when the Spanish explorers first brought them to North America, until the 1850s, when the discovery of gold in California led to the burro becoming the prospector's principal means of transportation (Douglas and Leslie 1996). When mines played out or when motorized vehicles became the more practical mode of transport, the miners' burros were released into the wild (NPS, 1979).

From about 1920 to the 1960s, burro populations were kept at low levels by government agencies like the National Park Service and by the public by organized and random shooting of the burros. These efforts to reduce or eliminate feral burros from national park lands were park managers' response to the burros damaging park resources and changing the ecological composition at the expense of the park's native biotic communities.

Ecological niches to which Pleistocene equids related do not exist today, and no other animals in the contemporary North American fauna would have the same niche relationships as the modern-day equids, with or without the latter's presence (NRC 1982).

In the 1950s the states of Arizona and California passed burro protection laws that limited the killing of these animals by private citizens. In the late 1960s, Grand Canyon National Park was prevented by public outcry from continuing the 40-year custom of shooting burros (NPS, 1979). In 1971 the Federal Wild Free-Roaming Horse and Burro Act was passed. This act limited the killing of horses and burros on public lands administered by the Bureau of Land Management and the U.S. Forest Service. This law does not apply to NPS lands.

Before the passage of the California Desert Protection Act, the Bureau of Land Management managed 13 herd management areas (HMAs) in the California Desert District. Now the agency manages nine herd management areas, with the four former herd management areas found within, and now managed by NPS units. Of the Bureau of Land Management's nine HMAs, four are outside the NEMO planning area and the other five HMAs abut the expanded National Park Service lands. Death Valley National Park and

Mojave National Preserve manage burros on lands recently acquired from the Bureau of Land Management at the same population numbers as established by the Bureau of Land Management before the California Desert Protection Act was passed. These management numbers are 297 burros and 9 wild horses for Death Valley and 130 burros for Mojave National Preserve.

The existing population levels for Mojave National Preserve and Death Valley greatly exceed the BLM's management levels. The estimated population is about 1,200 animals in Mojave National Preserve, and at least 400 burros in Death Valley. The current estimate is based on a September 1996 survey (Haley, 1996) that counted approximately 1,400 burros, adjusted to include a typical 15 percent annual population growth and the removal of 600 burros in 1997. Only one part of the preserve is adjacent to a BLM Herd Management Area, the Clark Mountain Herd Management Area. There are no wild horses in Mojave National Preserve. A total of 600 burros were captured and placed for adoption in September 1997. Alternatives for future management strategies are presented in this document.

Clark Mountain is the only HMA adjacent to the preserve. Approximately 45% of this HMA is now within the preserve boundary. The herd management level is 44 burros. The Bureau of Land Management's October 1996 population estimate is 202 burros.

TABLE 1: WILD HORSE AND BURRO POPULATION DATA FOR THE PLANNING AREA

	Horses	Burros
BLM's Pre-CDPA Management Levels	267	843
Post-CDPA Management Levels (Does not include burros and horses on NPS Land)	247	307
Estimated Population in entire California Desert District (BLM 1996 Population Estimates)	411	2,343
Estimated Death Valley National Park Populations (BLM herd management level)	12 (9)	350-550 (297)
Estimated Mojave National Preserve Populations (BLM herd management level)	0 (0)	1,300 (130)

On February 28, 1995, the superintendents of Death Valley National Park and Mojave National Preserve agreed to an interim management policy for burros on lands formerly managed by the Bureau of Land Management. The policy is to maintain the BLM-approved management levels until a final decision is derived through the formal planning process, which includes the preparation and public review of this document. That level is 130 burros for Mojave National Preserve and 297 burros and 9 wild horses for Death Valley National Park.

The National Park Service estimates that at least 110 burros from Death Valley National Park and 1,100 burros in Mojave National Preserve need to be removed to reach the BLM-approved management levels. Under this interim policy all wild horses and burros removed would be captured and made available for adoption to the public.

Since many of the herd management areas are adjacent to NPS lands, this plan, the Death Valley Draft Environmental Impact Statement / General Management Plan, and the Bureau of Land Management's amendment to the California Desert Conservation Area plan will consider options that are developed with BLM and NPS interagency cooperation for wild horse and burro management in units of the national park system and on lands managed by the Bureau of Land Management.

SPECIES AND HABITATS OF SPECIAL CONSIDERATION

Within the Mojave National Preserve are confirmed populations or potentially viable habitat for 3 federally endangered, 1 federally threatened, 6 state (California) endangered and 1 state threatened plants and animals. The tables in appendix D reflect the overlap of protective designations for these and a number of endemic species. The tables note additional plants ranked as CNPS 1B and several endemic plant and animal species not formally recognized by agencies as listed or rare.

LISTED SPECIES IN MOJAVE NATIONAL PRESERVE

Federally listed species known to inhabit the Mojave National Preserve are the desert tortoise (*Gopherus agassizii*) and the Mohave tui chub (*Gila bicolor mohavensis*). Final recovery plans exist for both of these species. The southwestern willow flycatcher (*Empidonax trailli extimus*) and least Bells vireo (*Vireo bellii pusillus*) are listed birds that could periodically inhabit riparian areas such as Piute Spring but have not been verified to occur in the preserve.

California listed species known to occur in the preserve are the desert tortoise, the Mohave tui chub, and the willow flycatcher (*Empidonax trailli*). The California (or western) yellow-billed cuckoo (*Coccyzus americanus occidentalis*), normally in need of broad riparian cover, may have some, but limited potential to appear in the preserve.

There are no known federally listed or proposed plant species in the preserve. California rare plant species that occur are July gold (*Dedeckera eurekaensis*) and rock lady (*Maurandya petrophila*).

The species detailed in the text below are designated as federally endangered (FE), federally threatened (FT), federally proposed threatened (FPT), California endangered (CAE), California threatened (CAT), California rare (CA Rare), Nevada critically endangered (NVCE) or Nevada threatened (NVT). Where indicated by a heading of more than one species, discussion is intended to reflect common or closely related habitat needs. Additional information about these and other species of special consideration not discussed below but known or likely to occur within NEMO can be found in appendix D.

Desert Tortoise (*Gopherus agassizii*)-FT, CAT

The range of the desert tortoise includes the Mojave and Sonoran deserts in southern California, Arizona, southern Nevada, the southwestern tip of Utah, and Sonora and northern Sinaloa, Mexico. The Mojave population of the desert tortoise (an administrative designation for animals living north and west of the Colorado River) is listed as a threatened species by the federal government and the State of California. Critical habitat for this species was designated in 1994 (FWS 1994).

The Mojave population of the desert tortoise primarily occupies valleys and bajadas characterized by scattered shrubs. The soils range from sand to sandy-gravel, though caliche soils, desert pavement, and rocky, boulder terrain are occasionally used (FWS 1994). Desert tortoises spend a large portion of the year underground to avoid extreme temperatures and, for younger tortoises, to avoid a variety of predators, such as coyotes, foxes, raptors, and ravens (BLM 1996). Tortoises generally are active during spring, early summer, and autumn when annual plants are most common and daily temperatures are tolerable. Additional activity occasionally occurs during warm weather in winter months and after summer rainstorms (BLM 1996).

As early as the 1970s biologists began to recognize that desert tortoise numbers were declining sharply in many areas. In 1984, the U.S. Fish and Wildlife Service listed the desert tortoise on the Beaver Dam Slope in Utah as a threatened species. The entire Mojave population was listed as a threatened species in 1990 (FWS 1994).

These declines are mainly attributed to direct and indirect human-caused mortality coupled with the inadequacy of existing regulatory mechanisms to protect desert tortoises and their habitat. (FWS, 1994)

Desert tortoise habitat has been destroyed, degraded, and fragmented as a result of urbanization, agricultural development, livestock grazing, mining and roads. The removal of tortoises by humans for pets or for use as food or folk medicine is also a major factor in the decline of the desert tortoise population (FWS 1994). A respiratory disease is an additional cause of desert tortoise mortality and population decline, particularly in the western Mojave desert (FWS 1994).

In June 1994, the U.S. Fish and Wildlife Service released the *Desert Tortoise (Mojave Population) Recovery Plan*, which presented recommended prescriptions for population recovery. Also included in this document are maps of the tortoise's critical habitat and of areas where recovery actions are recommended. These areas are called Desert Wildlife Management Areas (DWMAs). Within the NEMO planning area are the Fenner, Ivanpah, and Piute-Eldorado California Desert Wildlife Management Areas.

The range of the desert tortoise in the NEMO planning area extends from the southern boundary of the preserve north to the southern boundary of Death Valley National Park. About 52% of the preserve is designated as critical habitat for this species. Critical habitat extends north of the preserve into BLM lands in the Shadow Valley north to the southern

slope of the Kingston Range. Critical habitat is also found in BLM lands north of Nipton Road up to Ivanpah Dry Lake (FWS 1994).

In April 1994 the U.S. Fish and Wildlife Service issued a “Biological Opinion” for the Bureau of Land Management’s interim livestock grazing program in Mojave desert tortoise critical habitat. The FWS opinion concluded that for more than 2½ years the Bureau of Land Management could continue grazing operations under the management prescriptions that were in effect before the *Desert Tortoise Recovery Plan* was published. At the end of the 2½ years the Bureau of Land Management would fully implement the recommendations of the *Recovery Plan*. These operations were not considered likely to result in the destruction or adverse modification of designated critical habitat if the Bureau of Land Management managed grazing according to the FWS prescribed conditions. A portion of the grazing operations covered by the opinion became the responsibility of the National Park Service with the passage of the California Desert Protection Act.

In October 1996, the Bureau of Land Management and the National Park Service requested an extension of the 1994 “Biological Opinion” while this planning process is underway. On March 25, 1997, the U.S. Fish and Wildlife Service released a “Biological Opinion” for the Interim Livestock Grazing Program Proposed by the Bureau of Land Management and National Park Service in Mojave desert tortoise critical habitat (1-5-96-F-296R). This opinion allows time to complete and implement the recommendations made in this report, as well as recommendations arising from the Northern and Eastern Mojave Planning Effort. Within the Eastern Mojave Recovery Unit, the Bureau of Land Management and the National Park Service will continue to operate their grazing programs under terms and conditions described in previously prepared biological opinions (see page 7 of 3/25/97 “Biological Opinion”), and prohibit all off-highway vehicle activity, all clearing of land for agricultural uses, vegetation harvest, and landfill development within the Mojave National Preserve.

Mohave tui chub (*Gila bicolor mohavensis*)-FE, CAE

The Mohave tui chub (*Gila bicolor mohavensis*) is in the minnow family and can reach over 10 inches in length. The Mohave tui chub was listed as an endangered species in 1970 by the U.S. Fish and Wildlife Service. The Mohave tui chub is the only fish native to the Mojave River basin in California. The arroyo chub (*Gila orcutti*) was introduced into the Mojave River system in the 1930s. This exotic chub successfully hybridized with the Mohave tui chub, and by 1970 the latter fish species was believed to have been eliminated by this process of introgression. A small population of (believed) genetically pure Mohave tui chub was found at a small pond (6 feet deep and 9 feet in diameter) at Soda Springs on the western bank of the dry Soda Lake (FWS 1984). Since its rediscovery, populations have been successfully introduced to constructed ponds at Soda Lake, Camp Cady, China Lake Naval Weapons Center, and the Bureau of Land Management’s California Desert Information Center in Barstow, California. The total estimated population at these four areas is between 10,000 and 20,000 fish (Mohave tui chub recovery team meeting, November 1996).

The Mohave tui chub is morphologically similar to the Owens tui chub (*G. b. Snyderi*) and the Lahontan tui chub (*G. b. obesa*) (FWS 1984). A genetic study, completed in September 1997, found that the Mohave tui chub is a distinct subspecies (May et al. 1997).

RIPARIAN DEPENDENT BIRD SPECIES WITHIN NEMO

southwestern willow flycatcher (*Empidonax trailli extimus*)-FE, sp. level CAE
least Bells vireo (*Vireo bellii pusillus*)-FE
California/western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)-CAE

Mesic habitats in the planning area are not noted for high numbers of the riparian obligates listed above (relative to their known ranges), but such habitats do provide a degree of essential foraging and nesting habitat. To date, other than along the Colorado River, the study of the vireo and flycatcher in the desert have been concentrated along the Mojave River. Small numbers of all three species have been confirmed along the Amargosa River and in Death Valley.

In May 1986, *Vireo bellii pusillus* was federally listed. Its critical habitat was designated in February 1994. Endangered status took effect for *Empidonax trailli extimus* in March 1995, and a final determination of critical habitat was made in July 1997. Listing of the willow flycatcher by the state of California is at the species level. Federal recovery planning is underway for both the vireo and flycatcher. There is no critical habitat for either species in Mojave National Preserve.

The western yellow-billed cuckoo, listed by the state of California as endangered since 1988, generally requires a broader stand of riparian growth than the vireo or flycatcher. The loss of riparian habitat is the major common factor influencing the decline of all three species. The cuckoo does not appear to be affected by brood parasitism by the brown-headed cowbird (*Molothrus ater*), which is a severe problem for the vireo and flycatcher. In this behavior, cowbirds introduce their offspring to the nest and care of a host bird species, competing directly with the success of the host's young and sometimes eating or ejecting the host's eggs (Thelander 1994).

OTHER RARE PLANTS WITHIN NEMO

Thorne's buckwheat (*Eriogonum ericifolium* var. *thornei*)-CAE
Tecopa bird's beak (*Cordylanthus tecopensis*)-NVT
forked buckwheat (*Eriogonum bifurcatum*)-NVT
Kingston Mountain bedstraw (*Galium hilendiae* ssp. *kingstonense*)-NVT
curved-pod milk-vetch (*Astragalus mohavensis* var. *hemigyris*)-NVCE#
July gold (*Dedeckera eurekaensis*)-CA Rare
rock lady (*Maurandya petrophila*)-CA Rare

A varied complex of habitats in the planning area support the life requirements of several

listed and rare plant species. Among those specifically listed above, curved-pod milk-vetch (*Astragalus mohavensis* var. *hemigyris*), July gold (*Dedekera eurekaensis*) and rock lady (*Maurandya petrophila*) are associated with carbonate soils at least part of the time. Thorne's buckwheat (*Eriogonum ericifolium* var. *thornei*) and Kingston Mountain bedstraw (*Galium hilendiae* ssp. *kingstonense*) thrive at elevations upward of 4,000 feet in pinyon and juniper woodland. Tecopa bird's beak (*Cordylanthus tecopensis*) and forked buckwheat (*Eriogonum bifurcatum*) are lower elevation species dependent on moist alkaline soils and saline flats and rolling hills, respectively.

Realized or potential threats to these northern and eastern desert plants range from livestock grazing, trampling, mining, vehicle-use, and collection activities, as well as habitat alteration.

GAME ANIMALS

HUNTING AND TRAPPING

Hunting and trapping (under California Department of Fish and Game regulations) is allowed in the preserve. Hunted game species include mourning doves, quail, chukar, rabbits, bighorn sheep, and mule deer. These game species are not uniformly distributed in the Mojave National Preserve. The bighorn sheep prefer steep, mountainous, open terrain; the Rocky Mountain mule deer's preference is high-elevation Great Basin habitats; and the game birds' habitat of choice is the open desert areas near springs or guzzlers.

Mojave National Preserve is also one of the few places in California where bighorn sheep hunting is allowed. Limited hunting of bighorns began in 1987 (BLM 1988). A limited number of permits to hunt bighorn sheep are issued each year through a lottery system. One other permit in addition to the permits issued by the lottery system is awarded each year to the highest bidder, allowing him/her to hunt one animal.

Torres, et al. in their 1994 paper estimated that the number of bighorn sheep in or near the preserve at between 680 and 1,075 animals or more (Torres, S. G. et al. 1994).

Chukar have been introduced throughout most of the NEMO area. Rocky Mountain mule deer were introduced in the New York Mountains of the preserve in the late 1940s (see "Exotic Species" section).

TABLE 2: NORTHEASTERN SAN BERNARDINO COUNTY BUCK KILL DATA.

Year	Number of Tags Returned	Year	Number of Tags Returned
1988	29	1992	38
1989	29	1993	43
1990	26	1994	36

1991	28	1995	33
		1996	18

TABLE 3: HUNTING STATISTICS FOR SAN BERNARDINO COUNTY

ANIMAL	1992	1993	1994	1995
Chukar	37,873	15,001	5,007	5,063
Gambel's Quail	25,187	26,314	5,984	15,813
Dove	77,799	45,459	49,461	50,463
Jackrabbit	31,455	48,070	28,089	14,103
Cottontail	25,410	27,889	14,044	7,627
Coyote	3,769	4,144	2,280	1,841
Bobcat	?	?	81	99

From State of California memorandum, May 23, 1996

TABLE 4: BIGHORN SHEEP HARVEST

Year	Old Dad Unit	Clark Mountain Unit
1987	5	Not Open
1988	5	Not Open
1989	6	Not Open
1990	4	Not Open
1991	5	Not Open
1992	5	2
1993	4	2
1994	4	0
1995	3	0

From personal communication with Vern Bleich,
Eastern Units Supervisor, CDFG

TABLE 5: BIGHORN SHEEP POPULATIONS IN OR NEAR MOJAVE NATIONAL PRESERVE

METAPOPULATION*	POPULATION	POPULATION STATUS**	POPULATION SIZE CLASS
Central Mojave	Old Dad/Kelso/Marl	N	201-300
	Granite	N	<25
	Providence	N	25-50
	Wood/Hackberry	N	51-100
	New York	N	<25
	Castle/Hart/Piute	N	<25
	Dead	N	25-50
Central North Mojave	Clark	N	101-150
	Kingston/Mesquite	N	101-150
	Nopah	N	51-100
	Soda	E	0
	Avawatz	N	25-50
	Cady ⁺⁺		25-50
Population Range			680 – 1,075

From, Torres et al. 1994, "Status of Bighorn Sheep in California, 1993, 1994 Desert Bighorn Council Transactions, pp. 17-28

* Metapopulation = Population management areas

**N = Native R = Reintroduced E = Extirpated

⁺⁺ From T. Egan, pers. comm., 1997

SPECIES RESTORATION

The National Park Service's policy is to strive to restore native species to parks. See "Alternatives" section for details about restoration policies and programs. Such programs will be carried out in cooperation with other affected agencies, organizations, and individuals.

Any necessary confinement of animals in small fenced areas during restoration efforts will continue only until the animals have become thoroughly accustomed to the new area or they have become sufficiently established to minimize threats from predators, poaching, disease, or other factors (NPS 1988, 4:10 and 11).

The preserve was a former part of the range of at least one extirpated species, the pronghorn antelope (see references below). Subspecies of animal are still extant, but its pre-Columbian distributions have been drastically reduced by the direct result of human action. If at some time in the future a reintroduction of this species was planned, the above

criteria would have to be met, along with public involvement and the preparation of a management plan and the necessary environmental compliance documents.

PRONGHORN ANTELOPE

The pronghorn antelope's pre-Columbian range included California's Mojave Desert (Sampson and Jaspersin 1963). In June 1862 John Brown reported his hunting of antelope in the vicinity of Marl Spring, which is within the present Mojave National Preserve (King and Casebier 1981). Uncontrolled market hunting (a commercial enterprise that hunted and sold game animals for human consumption) and conflicts with agriculture are thought to have been the major factors in the species' extirpation in many parts of their former range. Farmers and sheep growers are said to have killed large numbers of antelope to conserve their crops and sheep forage. As early as 1854 the antelope hunting season was closed, but market hunters continued their depredations despite the law. Extensive agricultural development replaced much of the antelope's natural habitat. The antelope began to use cultivated crops as a replacement for their native forage.

GUZZLERS (WATER CATCHMENTS)

A guzzler is a permanent self-filling water catchment. Most are similar to a cistern and are simple, low-maintenance devices that are essentially tanks filled by rain-collecting aprons (Giles 1971). Guzzlers are installed and used to provide water for hunted species in arid areas. Nongame species such as reptiles, songbirds, and insects also use these manufactured devices. Birds enter the covered tank through an opening and walk down a ramp to the water. For bighorn sheep, piping extends from the storage tank to a drinking trough, which has a float valve to regulate the flow.

Game numbers have been increased greatly in parts of the arid West by the use of guzzlers (developed by Ben Glading, California Department of Fish and Game) (Dasmann 1964). Professor Dasmann warned that while the guzzler is functioning, animal numbers should be limited to the area's carrying capacity as "excess numbers of game can easily damage food and cover in areas near water, and in arid lands this damage is long lasting" (Dasmann 1964). This type of damage has been observed in the Mojave Desert near big game guzzlers but not in guzzlers designed for game bird use (McGill, personal communication).

A disadvantage of guzzlers is that dead tortoises are sometimes found in them and the believed cause of death is drowning (Frank Hoover, pers. comm., 1995). In an examination of guzzlers on BLM lands, one in four were found to contain large dead mammals, and one in five were found to contain dead tortoises (McGill, in preparation). McGill further observed that all guzzlers with dead animals in them were constructed of fiberglass. McGill has not observed any animal carcasses in concrete guzzlers. The U.S. Fish and Wildlife Service recommends that "If guzzlers are constructed, they should include fencing or other means to exclude tortoises" and that existing guzzlers should be retrofitted with

exclusion devices (FWS 1996). McGill recommends that fiberglass guzzlers be fitted with escape ramps, as he has observed no mortality in these types of guzzlers.

There are more than 100 artificial water impoundments in the preserve including livestock tanks and troughs, six big game and 133 game bird (gallinaceous) guzzlers. The guzzlers were developed by the California Department of Fish and Game, the Bureau of Land Management, and volunteers before the area was designated a national preserve in 1994.

FIRE MANAGEMENT

Research began in fiscal year 1998 (FY98) to examine the history of fire and its effects on the natural environment. Results from this research and other information will be used in the developing a fire management plan. Preparation of the plan is scheduled to begin in FY99.

PALEONTOLOGICAL RESOURCES

The national preserve area contains a rich and diverse, but fragile and irreplaceable paleontological record. The fossil record in the national preserve is nearly as extensive and complicated as the geological record. Much of the area's geology is exceptionally well exposed. Soil development has been greatly retarded throughout much of the area, and the outstanding exposures of geological features support an equally notable exposure of fossil remains. These organisms have value as (1) stratigraphic indicators for correlation of deposits containing them and for determination of relative geologic age, (2) records of past life forms showing the course of evolutionary trends of plants and animals, and (3) evidence of changing paleoenvironments.

A literature and records search was completed for the national preserve area by Robert E. Reynolds, Curator, Earth Sciences, San Bernardino County Museum, Redlands, California. The records and literature search identified a number of potentially sensitive fossiliferous areas in the planning area. Significant paleontological resources and records relating to paleobiostratigraphic events that occur within or near the national preserve are as follows:

- The world's oldest mitosing cells, 990 million years old, are preserved in silica in the Beck Spring Formation.
- Significant Cambrian trilobite and invertebrate fossil localities mark the boundary of the Paleozoic Era, 550 million years of age.
- The only dinosaur tracks in California and the only record of Jurassic dinosaurs in California are in the Mescal Range north of the Mojave National Preserve.

- Early records of crustal extension and breakup that occurred 24 million years ago to form basins in the Mojave Desert are found in or near the national preserve. Significant occurrences of fossils, including rhinoceros, camel, canid, felid, bird track, and plant, are located in the Ship Mountains, Little Piute Mountains, Hackberry Mountains, Castle Mountains, Lanfair Valley, and Wild Horse Mesa in or near Mojave National Preserve.
- There are significant Plio-Pleistocene fossil localities, which are being damaged by erosion and amateur collecting, at Valley Wells and Kingston Wash.
- Cave deposits in the Mescal Range have produced significant vertebrate fossils.

CAVE RESOURCES

There are significant limestone caverns in the preserve that are found within the Providence Mountains State Recreation Area, which is operated by the California Department of Parks and Recreation. The Mitchell Caverns Natural Preserve was established in 1954 to protect and interpret two caves connected by a man made tunnel. The 97 acre-Mitchell Caverns Natural Preserve is within the larger 5,890-acre Providence Mountains State Recreation Area. The developed cave area consists of two small, but well decorated caves. A tunnel connected the two caves, known as El Pavika and Tecopa, in 1968. The caves contain areas of interesting speleothems, provide roost area for at least two species of bats (one of which is *Plecotis townsendii*), and may hold archeological material in the entrance areas.

Cave of the Winding Stair is a small but deep cave in the recreation area, open by permit to experienced vertical cavers. Several other small and unsurveyed caves exist within the local area. Very little is known about these caves and a comprehensive inventory is needed.

The Lava Beds area of Mojave is also known to contain at least one lava tube. This cave has a constructed ladder at the entrance. Other tubes may occur, but a comprehensive inventory has not been completed.

CULTURAL RESOURCES

ARCHEOLOGICAL RESOURCES

Various cultural resources studies have examined archeological resources in the Mojave National Preserve area. The most significant studies are: Davis, Brown, and Nichols, *Evaluation of Early Human Activities and Remains in the California Desert* (1980); Warren, Knack, and Warren, *A Cultural Resource Overview for the Amargosa-Mojave Basin Planning Units* (1980); Brooks, Wilson, and Brooks, *An Archaeological Inventory Report of the Owlshead/Amargosa-Mojave Basin Planning Units of the Southern California Desert Area* (1981); King and Casebier, *Background to Historic and Prehistoric Resources of the East Mojave Desert Region* (1981).

PLEISTOCENE ERA

Although evidence of human occupation during the Pleistocene Era remains a controversial subject, some researchers have suggested a pre-projectile point horizon where a crude flaking technology was used and where the ancient lakeshores may have provided a favorable environment for human occupation.

LAKE MOJAVE PERIOD, 10,000-5000 B.C.

The Lake Mojave complex, which most archeologists consider to be a Paleo-Indian assemblage, is also thought to be ancestral to the early Archaic cultures of the Pinto period.

This complex has become the comparative unit for “Early Man” in the Mojave Desert, and similarities to sites in the western Great Basin and to the San Dieguito complex of southern California have been noted.

Sites of the Lake Mojave period are nearly always limited to the surface, and it is possible that two or more assemblages are represented at some of these sites. Many of the sites are associated with shoreline features of Pleistocene lakes, such as the shorelines of extinct Lakes Mojave and Manly, and near springs.

PINTO PERIOD, 5000-2000 B.C.

Dramatic environmental changes came to the Mojave Desert with the end of the Pleistocene Era, characterized by harsh climatic conditions with higher temperatures and lower precipitation. Lakes and rivers dried up, and available resources were much reduced. Human adaptation to these new environmental conditions appears to be represented by the Pinto period assemblages.

The Pinto sites are most often limited to surface manifestation or have poorly developed middens with relatively low artifact density. They appear to have been seasonal camps of small groups of highly mobile people. The small number of Pinto period sites, together with their apparent temporary occupation of hunting large and small game and collecting vegetable resources, suggests that the population was sparse and poorly adapted to the increasingly arid conditions of the desert environment. During particularly arid periods, they probably withdrew to the margins of the desert and to perennial springs and microenvironments less affected by the overall climatic deterioration, and during more moist periods they likely expanded their territory in the lower desert areas to take advantage of the shallow lakes, marshes, and springs. During the later part of the Pinto period, when the Mojave Desert was at its most arid, the population of the Mojave Desert seems to have decreased, although a mosaic of microenvironments permitted localized habitation throughout the desert.

GYPSUM PERIOD, 2000 B.C.–A.D. 500

The beginning of the Gypsum period coincided with the commencement of a more moist climatic era, often referred to as the Little Pluvial, about 2000 B.C. The Gypsum period was a time of intensive occupation of the desert coupled with a broadening of economic activities and increasing contact with the California coast and the Southwest. The bow and arrow were introduced late in this period, making hunting more efficient.

Although hunting continued to be an important economic pursuit during the Gypsum period, milling stones and handstones became common during this period, indicating increased use of plant foods and reliance on hard seeds. Mortars and pestles and manos and metates are reported at Mesquite Flat in Death Valley and on the Amargosa River, where they dated between 2080 and 3250 B.C. These sites are located near or in mesquite groves, suggesting that the processing of mesquite pods with the mortar and pestle may have become an important element in the subsistence system.

Generally, the Gypsum period was a time in which the Mojave Desert population incorporated new technological items and ritual activities and increased socioeconomic ties through trade. Because of these new means of adaptation, the return of arid conditions toward the end of the Gypsum period had relatively little effect on the Mojave Desert's population density and distribution.

SARATOGA SPRINGS PERIOD, A.D. 500–1200

In the northern Mojave, from Death Valley to the Sierra Nevada, the sites of the Saratoga Springs period appear to exhibit cultural continuity with the Gypsum period, change being most apparent in the reduction in size of projectile points as a result of the introduction of the bow and arrow. During the Saratoga Springs period, there appears to be a refinement of adaptation to the arid environment of the northwest Mojave, and

presumably the beginnings of the eastward expansion across the Mojave of Numic-speaking groups, who were the ancestors of the historic Shoshone and Paiute who inhabited the region at the time of Euro-American contact.

Essentially, the same assemblage was present across the Mojave Desert north of the Mojave River. However, Basketmaker-Pueblo influences increased with Anasazi occupation of the lower Virgin and Muddy Rivers. Research suggests that the Anasazi controlled turquoise mines near Halloran Spring in the east-central Mojave between about A.D. 700 and 900, followed by Hakataya peoples, who withdrew about A.D. 1200–1300. Finally, the Southern Paiute used the area in late prehistoric times. The mining of turquoise resulted in Anasazi influence in much of the eastern Mojave, because small parties of these Virgin and Muddy River villagers used the region for intermittent and seasonal foraging. The extent of these forays has not been determined, but it appears to have been considerable, particularly in well-watered areas such as Las Vegas Valley, Ash Meadows, and the Spring Mountains. The area of this influence can be mapped by the distribution of Anasazi sherds occurring in considerable frequency at sites in southern Nevada and in California as far west as the Cronise Basin, west of Soda Lake. Anasazi influence set the eastern Mojave apart from the remainder of the desert.

During this time, the Mojave River also developed as a trade route between the Colorado River and the California coast. As a result of this trade, the ceramic and projectile point styles of the lower Colorado River spread through the Mojave River Valley, along with shell beads and ornament styles from the coastal region.

The cultural development of the Mojave Desert south of the Mojave River and Providence Mountains diverged from that in the northern area during this period. Few points of the Rose Spring series and virtually no Anasazi pottery occur in the southern Mojave. Artifact types, such as knives, drills, milling stones, mortars and pestles, stone pipes, bone awls, and shell and stone ornaments show close similarities to their counterparts in the later pottery-bearing sites along the Mojave River.

SHOSHONEAN PERIOD, 1200 A.D.–EURO-AMERICAN CONTACT

The Shoshonean period clearly anticipates the historic Native Americans with evidence of bow and arrow hunting, exploitation of plant resources using milling stones, and use of circular houses. The Anasazi influence faded after A.D. 1200 as a result of changes in climatic conditions, population movements, settlement patterns, social organization, and trade alignments.

The Mojave River Valley and the southern Mojave continued to be influenced by the well-developed trade system in which the Antelope Valley people of the western Mojave functioned as middlemen between California coastal and interior populations. Village sites on the upper Mojave developed, apparently dependent in part on the trade with the coastal region. Compared with other parts of the desert region, these villages appeared to be more elaborate; there are house pits, more abundant shell beads and ornaments, and

the painting of utilitarian items such as metates with several different colors of pigment. Late in the Shoshonean period (ca. A.D. 1650), the trade networks involving both the Mojave River and Antelope Valley peoples appear to have been disrupted, bringing an end to the villages in Antelope Valley and reducing the intensity of activity along the Mojave River.

HISTORIC ARCHEOLOGY

Historic archeological sites in the NEMO planning area are largely associated with transportation corridors, water sources, and mining operations during the late 19th and early 20th centuries.

STATUS OF ARCHEOLOGICAL RESEARCH

To date, archeological work in the national preserve has been driven primarily by compliance actions related to specific development projects, and no systematic, scientific archeological surveys have been conducted. Archeological sites in Mojave National Preserve include prehistoric villages with rock shelters, petroglyphs, and pictographs, as well as quarries and high-density lithic scatters in the Providence Mountains; petroglyphs in the Woods Mountains, Cinder Cones, and Lanfair Valley; large open sites, rock shelters, and pictographs in the Granite Mountains; numerous clusters of fire-affected rocks with associated pottery, milling assemblage, and lithic tools in the vicinity of Pleistocene lakeshores; large roasting pits associated with limestone formations in the Mescal Range and Clark Mountains; an extensive string of campsites, milling sites, and lithic scatters in the Piute Range; and campsites and petroglyphs associated with prehistoric trails connecting the Colorado River with the Pacific Coast.

LANDFORMS AND ARCHEOLOGICAL RESOURCES

While archeological sites are found on virtually every type of landform in the NEMO planning area, the persistent association of certain features with archeological sites allows for fairly reliable estimates about the types of landforms that are likely to support sites. Proximity to fresh water and food resources are the primary variables influencing Native American site location. For example, a spring in or near a mesquite grove would be an optimal location for a site. An alluvial fan generally lacks resources and would not have been a primary occupation or food collecting and processing site, but it could have been the location of food storage facilities or a temporary campsite, trail, burial site, or rock art site, all of which fall outside the parameters of a model based solely on subsistence variables.

However, previous environmental conditions must also be considered. Ancient late Pleistocene Era/early Lake Mojave Period beach features associated with now-extinct

lacustrine and riparian habitat were prime occupation or food collecting and processing sites over 6,000 years ago, in spite of what the present landscape may look like.

Euro-American sites, while generally more easily identified than prehistoric sites, are generally associated with transportation networks and resource procurement/exploitation features. In the NEMO planning area, transportation routes, water sources, and mining operations are prime locations where such archeological sites may be found. The network of interconnecting roads is usually preserved and is easily discernible from aerial photographs and early maps.

NATIONAL REGISTER OF HISTORIC PLACES

Three prehistoric archeological sites or districts located in or near the national preserve are listed on the National Register of Historic Places:

Piute Pass Archeological District – August 14, 1973.

Aiken's Wash National Register District (Baker Vicinity) – May 24, 1982.

Aiken's Wash Archeological Site "J" (Baker Vicinity) – May 24, 1982.

Eleven archeological sites in or near the national preserve were determined eligible for listing on the national register on May 24, 1982:

Archeological Site, CA SBR 2759 [also known as Aiken Willows Cave]

Archeological Site, CA SBR 2760 [also known as Aiken Willows Petros I]

Archeological Site, CA SBR 2761 [also known as Aiken Willows Petros II]

Archeological Site, CA SBR 2762 [also known as Aiken Willows Petros III]

Archeological Site, CA SBR 2817 [also known as Aiken Willows Petros IV]

Archeological Site, CA SBR 2842 [also known as Aiken Willows Petros V]

Archeological Site, CA SBR 2843 [also known as Aiken Willows Petros VI]

Archeological Site, CA SBR 2844 [also known as Aiken Willows Petros VII]

Archeological Site, CA SBR 2763/H [also known as Aiken Tanks Petros]

Archeological Site, CA SBR 3150 [also known as Aiken Wash Alignment]

Archeological Site, CA SBR 7011 [also known as Aiken Cinder Mine Petros]

HISTORIC RESOURCES

Various cultural resource studies and publications have examined historic resources in Mojave National Preserve. The most significant studies and publications are Westec Services, Inc., *A History of Land Use In the California Desert Conservation Area* (1978); Warren, Knack, and Warren, *A Cultural Resource Overview for the Amargosa-Mojave Basin Planning Units* (1980); Norwood and Bull, *A Cultural Resource Overview of the Eureka, Saline, Panamint and Darwin Region, East Central California* (1980); King and Casebier, *Background to Historic and Prehistoric Resources of the East Mojave Desert*

Region (1981); Vredenburg, Shumway, and Hartill, *Desert Fever: An Overview of Mining in the California Desert* (1981).

There is an impressive inventory of historical resources in the Mojave National Preserve area. The mountains and valleys contain sites associated with early Spanish and American exploration and survey of the vast Mojave Desert region, and the area is laced with remnants of prehistoric and protohistoric Native American trails as well as Euro-American trails, wagon roads, railroads, highways, and other early transportation arteries. The region contains numerous remnants of abandoned mining operations, sites of settlements long gone and nearly forgotten, railroad grades and railway structures, and sites associated with military operations against the Native Americans. Fencelines, water tanks, and corrals testify to a continuing ranching-grazing industry; scattered remains of homesteads tell of a time when dryland farming was attempted in this arid land; and the outlines of military camps are reminders of the days during World War II when American troops trained for campaigns in other parts of the world.

EXPLORATION

The first Euro-American exploration expedition to enter the NEMO planning area was led by the Spanish priest Francisco Garces during 1775 – 76. Garces, a Franciscan stationed at San Xavier del Bac near present Tucson, Arizona, accompanied Captain Juan Bautista de Anza on the latter's second expedition to California as part of the Spanish effort to settle Alta California. After Anza's main party crossed the Colorado River near present Yuma, Garces, accompanied by Indian companions, attempted to find a new trade and communications route between the Spanish settlements in Alta California and the upper Rio Grande Valley in New Mexico by traveling up the Colorado as far as the Mojave villages, and then with Mojave Indian guides crossing the Mojave Desert on what would become known as the Mojave Indian Trail through present Mojave National Preserve, and eventually arriving at Mission San Gabriel near present Los Angeles. Later, still accompanied by Mojave guides, he returned to the Mojave villages, crossing the Mojave Desert over a more northerly route through the present national preserve.

After the Mojaves committed various depredations against the Spanish settlements, Lieutenant Gabriel Moraga led a force of about 50 men to strike the Mojave homeland. Leading his force down the Mojave River and eastward into the desert, the Moraga expedition progressed one full day's travel east of Soda Lake before being forced to turn back by desert conditions.

In 1826, Jedediah Strong Smith, credited with being the first United States citizen to reach the Mexican settlements in California overland, crossed the Mojave Desert via the Mojave villages on the Colorado River and the Mojave Indian Trail. He made a repeat trip in 1827, and during the next several years a steady flow of American "mountain men," including prominent personalities such as William Wolfskill, George C. Yount, Christopher "Kit" Carson, and Ewing Young would enter California via the Mojave

villages and the Mojave Indian Trail. For the most part, these early travelers were fur trappers looking for new untapped fields.

During 1853–54, informal exploration by Francois X. Aubry, and more extensive expeditions by U.S. Army engineer Lieutenants Robert S. Williamson and Amiel W. Whipple, traversed the present Mojave National Preserve in attempts to identify the most practicable route along the 35th parallel for a transcontinental railroad across eastern California. These explorations resulted in the acquisition of significant topographic and scientific information about the 35th parallel route.

George M. Wheeler's extensive topographic and scientific surveys west of the 100th meridian for the U.S. Corps of Topographical Engineers during the 1870s earned him national recognition and made an invaluable contribution to the knowledge of the West. During his first major expedition in 1871, Wheeler's men reconnoitered some 72,250 square miles, covering portions of lower Nevada, eastern California, southwestern Utah, and northwestern, central, and southern Arizona, including the Mojave Desert. The success of this expedition enabled Wheeler to obtain congressional support for the extensive program of exploration that he would undertake throughout the rest of the decade. During 1875 his detachments again penetrated Death Valley via Darwin Canyon and Panamint Valley, and the Mojave from the south edge of Death Valley to the Colorado River. The Wheeler surveys recorded data on archeology, geology, botany, zoology, and Native Americans and developed topographic maps of the region.

During the late 1890s and early 1900s, state and federal government geologists arrived in the area that is now the Mojave National Preserve to conduct the initial scientific studies of the area's geological formations and mineralogical potential. Surveyors from the U.S. Geological Survey mapped most of the area during the early 1900s, producing the first reliable topographic maps of the region. In 1909 Walter C. Mendenhall, who would later become director of the Geological Survey, issued a guide to the "watering places" throughout the eastern California-southern Nevada desert country, providing detailed information and maps on the main routes of travel and the location and description of irrigating and artesian waters and springs in the region.

TRANSPORTATION

The lands in the Mojave National Preserve have served as an east-west transportation corridor across the eastern Mojave Desert since prehistoric times, spanning the range from Native American trails to travel by horse, mule, wagon, railroad, and automobile. Variants of the Mojave Indian Trail, used by Native Americans for centuries, were followed by explorers, mountain men, and traders beginning during the late 1820s, establishing what would become known as the Old Spanish Trail.

Because sectional conflict that would ultimately lead to Civil War prevented the construction of a transcontinental railroad until the 1860s, attention turned to developing and improving of wagon roads and postal routes to connect "the States" with the

American Southwest that the United States had acquired as a result of the Mexican War. During 1857 – 60 Edward F. Beale served as superintendent of a project to survey and improve a wagon road over the 35th parallel route from Fort Defiance, New Mexico (present northeastern Arizona) to the Mojave villages on the Colorado. As part of his work, Beale's crews improved the Mojave Indian Trail through the eastern Mojave to Los Angeles. While making his wagon road improvements, Beale conducted his noted "camel experiment," using camels that had been imported by the U.S. War Department during 1855 –56. By the summer of 1858, at least five emigrant wagon trains had attempted to use the new route to travel from New Mexico to Los Angeles.

Encountering extreme hardships and attacks by the Mojave Indians at the Colorado River in August 1858, the emigrant trains were forced to return to New Mexico, halting use of the 35th parallel route as an overland transcontinental route. In response, Major William Hoffman led the "Colorado Expedition" against the Mojaves, arriving at their villages in late April 1859. The Mojaves surrendered to Hoffman's superior force, and a post known as Fort Mojave was established on the east side of Beale's Crossing of the Colorado. The post, which would remain until 1890, controlled the Mojave tribe and served as a depot for army operations in the eastern Mojave Desert in California, southern Nevada, and northwestern Arizona. Using government teams with civilian teamsters, wagonmasters, and herders, Captain Winfield Scott Hancock, U.S. Army quartermaster in Los Angeles, supplied distant Fort Mojave via Beale's wagon road, which has become generally known as the Mojave Road. The Mojave Road continued to serve as the major thoroughfare across the eastern Mojave until 1883, when a railroad was built across the desert from San Francisco via Daggett to Needles. During the 1870s immense herds of sheep and other livestock were driven over the Mojave Road to Arizona and New Mexico when new ranges were discovered that were becoming safe from Indian threats.

In 1860 Major James H. Carleton led the 1st Dragoons against the Southern Paiutes and Chemehuevis, commonly referred to as Pah-Utes, who had undertaken periodic attacks against wagon trains on the Mojave Road in the eastern Mojave in defense of their water sources, game, and traditional lifeways. During the course of his campaign, Carleton and the Indian peoples engaged in a series of running skirmishes at Old Dad Mountain, Marl Springs, the Providence and Granite mountain ranges, Kelso Dunes, and the Devil's Playground. Carlton established an army post on the Mojave River, which he named Camp Cady, as well as a short-lived adobe redoubt at Soda Springs. Isolated depredations against wagon trains persisted after 1860, and when the Arizona Overland Mail used the Mojave Road as a postal route during 1866–68, the U.S. Army established relay posts across the desert at Soda Springs, Marl Springs, Rock Spring, and Piute Creek to provide escort riders for the mail carriers. Military authorities at Fort Mojave made peace with the Pah-Utes in 1867, and by 1870 the Indians had ceased to be a factor of concern to the growing numbers of Euro-Americans who were entering the region to establish mines and ranches.

During the early 1880s, the Atlantic and Pacific Railroad, owned in part by the Atchison, Topeka and Santa Fe, began construction along the 35th parallel route from the east. The Southern Pacific (closely linked with the Central Pacific and led by Collis P. Huntington,

one of California's major railroad magnates) began construction of a rail line southward from San Francisco to meet the Atlantic and Pacific at Needles. By April 1883 the Southern Pacific Line was completed across the eastern Mojave from Mojave to Needles, and in May the Atlantic and Pacific reached the opposite bank of the Colorado. After a settlement between the two railroads, the Colorado River was bridged, and on August 9, 1883, the 35th parallel rail line was connected, thus opening a transcontinental route between California and Springfield, Missouri. This rail line, now owned by the Burlington Northern Santa Fe Corporation, would stimulate the economic and mining development of the eastern Mojave.

The Nevada Southern Railroad completed a line from Goffs to the mining settlement of Manvel in the New York Mountains by the summer of 1893. Reorganized as the California Eastern Railroad Company in 1895, the rail line was extended to the Ivanpah Valley in 1901–02. The Santa Fe took over the railway in 1902, and, during 1906–07, a branch line was constructed from Barnwell (formerly Manvel) to Searchlight, Nevada. That branch operated until 1923.

The San Pedro, Los Angeles, and Salt Lake Railroad, jointly owned by copper king William A. Clark (who established the company in 1901) and Edward H. Harriman of the Union Pacific Railroad (who had subsequently purchased one-half of the company's stock) constructed its tracks through the present Mojave National Preserve in 1905, thus filling the last significant gap in transcontinental railroad lines from Salt Lake City to Los Angeles. Later, this "Salt Lake Route" to southern California, officially renamed the Los Angeles and Salt Lake Railroad, would be fully controlled by the Union Pacific, and the company would construct the extant mission revival style Kelso Depot in 1924 to serve as a hotel, restaurant, and office for train crews that provided 24-hour essential helper (engine) service 19 miles eastward from Kelso to the top of Cima Hill. Cima emerged as a small railroad community, featuring a wye on which the helper locomotives from Kelso could be turned to return to Kelso.

During the early 1900s, Francis M. "Borax" Smith attempted to tap his Amargosa Valley borax properties near Death Valley with a traction road consisting of a rock-based wagon road from his newly developed Lila C. Mine to the California Eastern railhead at Ivanpah II (there were three settlements with the name of Ivanpah). In April 1904 a traction engine left Ivanpah on the inaugural trip, but it completed only 14 miles before bogging down. Smith then determined to build the Tonopah and Tidewater Railroad, extending northward from Ludlow through the Mojave National Preserve area to Beatty, Nevada. Operating from 1907 to 1940, the railroad, along with its feeder lines, tapped the growing mining settlements in the present day Mojave National Preserve area.

With the emergence of the automobile age, efforts were initiated to develop a highway system across the United States. The Mojave Road served as the antecedent for the eastern Mojave portion of the "Ocean-to-Ocean Highway," sometimes referred to as the "National Old Trails Highway," which was constructed in 1914 between San Bernardino and Needles. Eventually this highway would become known as Route 66, a transcontinental road connecting Chicago with Los Angeles. The highway, which skirted

the southern edge of the Mojave National Preserve area, was paved during the 1930s with funds and manpower provided by Depression-era public works agencies. Route 66 became a significant transportation artery during the Depression for people who wanted to leave the Dust Bowl to make a new start in California. During the early 1970s Route 66 was replaced by Interstate 40, and today the historic route, known as the National Old Trails Highway (determined eligible for listing on the national register as an archeological district on April 26, 1993), serves as a nostalgic reminder of early automobile transcontinental travel.

The Arrowhead Trail, originally marked from San Bernardino via Las Vegas to Salt Lake City during 1914 – 16 and realigned as U.S. 91 during the late 1920s, was replaced by present-day Interstate Highway 15 during the 1960s. The highway skirts the north edge of the national preserve.

MINING

Gold and silver discoveries in the Colorado River Basin during the late 1850s and early 1860s sent hundreds of prospectors trekking across the eastern Mojave. As a result, prospectors discovered silver near Rock Spring in the present Mojave National Preserve, and the Rock Spring (or Macedonian) Mining District was established in 1863. Silver deposits were soon discovered south of the Mojave Road in the Providence Mountains. For the next several years, mining camps proliferated in the Providence Mountains/Mid Hills/New York Mountains region, but the principal settlement was at Rock Spring, where the first post office in the present national preserve was established in 1866.

Although the mines in the Providence, Coso, and Slate ranges were vacated during the late 1860s because of trouble with Native Americans who sought to protect their traditional lands against the influx of Euro-American miners, the threat of Indian attack was removed by 1870, and prospectors began heading back to the abandoned portions of the desert. The Copper World was discovered near Valley Wells southwest of Clark Mountain about 1868, and silver was discovered south of Clark Mountain in 1869, resulting in establishment of the first site of Ivanpah, where much of the mining history of the eastern Mojave would be centered during the 1870s. Silver continued to be mined in the Macedonia District in 1872 and in the New York Mountains during 1873.

The prosperous national economy after the Civil War stimulated mining ventures in the California desert region, but the bank panic in 1873 and subsequent depression curtailed speculative capital for mining. The coming of the railroads during the 1880s stimulated new mining ventures in the eastern Mojave, particularly in San Bernardino County. Ivanpah, worked since 1870 for silver, was developed by two companies in 1880 – 81. Two prospectors from Ivanpah discovered the rich Bonanza King silver mine on the eastern slopes of the Providence Mountains, resulting in establishment of Providence, which flourished during 1883 – 85, and Crow Town. The Cambria Mine at Nantan was active during 1885 – 86.

Gold mining dominated mining ventures in the eastern California desert region during the 1890s, the Panic of 1893 resulting in political decisions favorable to gold interests over those of silver ventures. During this time, the widespread use of cyanide for treating gold ore sent many prospectors out to rework old dumps, and formerly unprofitable mines were reopened. These developments led to discovery and development of the Gold Bronze and Boomerang mines in the New York Mountains, the Telegraph Mine near Halloran Springs, and the Paymaster (Whitney) Mine near Old Dad Mountain southeast of Baker. The rise in copper prices during the 1890s resulted in reopening the Copper World Mine in 1898. Other mining ventures included development of copper, lead, and silver deposits in the New York Mountains, where the town of Vanderbilt was established, its name being chosen to signify the great wealth that the mines were believed to possess. The rich gold mine of Bagdad Chase, southeast of Ludlow and several miles outside the national preserve, was discovered about 1898, and during 1904 – 52 this mine would produce more than \$6,000,000, or more than half of the recorded gold mined in the San Bernardino County since 1880.

Not until the early 1900s did conditions become conducive to large-scale hardrock mining operations in the eastern California desert region, prompted in part by the improvement of transportation facilities and by a renewal of interest in gold and silver. The significant discovery at Goldfield, Nevada, in 1903 led to a stampede early the following year. During the fall of 1904, the mining rush extended southward to Rhyolite and soon spilled over into Inyo and San Bernardino counties in eastern California. A variety of metallic minerals were exploited in the national preserve area during the 1900s, including gold (Castle Mountains, and Old Dad Mountain; copper (Vontrigger Hills, Clark Mountain); lead, zinc and silver (Mid Hills, [especially the Death Valley Mine], Mountain Pass). This activity resulted in the formation of boomtowns whose progress paralleled for a time the maturation of Goldfield, Tonopah, and Rhyolite in Nevada. Ephemeral mining camps, such Vontrigger Camp, Goldbend, Gold Valley, Gold Park, Dawson, Kewanee, and Hart, sprang up throughout the desert region. These mining ventures flourished until the financial panic of 1907, which resulted in an immediate slowdown of work and often total cessation of mining activity.

Although the inflationary 1920s put a damper on new mineral discoveries and mining development in the California desert, some mining activity continued. Since the early 1920s, clay used for ceramic purposes has been mined in the Castle Mountains. During 1924 – 25, gold was discovered north of Goffs on the south slope of Hackberry Mountain, and a new Vontrigger camp emerged.

The 1930s witnessed a revival of gold mining in the desert. Although the major discoveries occurred in Kern County, older districts, such as the Vanderbilt, experienced revivals. Prospecting was conducted where gold was known to have occurred, and some new discoveries were made as a result of this heightened interest.

The United States recovered from the Depression largely as a result of the worldwide demand for industrial and military-related products with the onset of World War II. Factories were placed in full production to turn out war materials, and the government

paid premium prices for minerals such as tungsten, antimony, manganese, iron, copper, lead, and zinc necessary for military industrial production. Mines producing these ores, such as the Kaiser Steel Company's Vulcan Mine northwest of Foshay Pass in the Providence Mountains, which provided more than 2,000,000 tons of iron ore during 1942 – 48 to supply its new steel mill at Fontana, prospered during the war. Concerned that more than 20,000 men were employed at 250 gold mines and 700 placer mines throughout the western United States, the War Production Board issued Limitation Order L-208 on October 8, 1942, classifying gold mines (lode mines producing less than 1,200 tons in 1941 were exempt) as nonessential for the war effort and giving mine owners 60 days to cease operations.

Uranium fever, much like the gold fever of earlier days, swept the eastern Mojave during the mid-1950s. Tungsten prospecting revived after World War II, and a major talc industry that had begun during World War I (but had never thrived because of limited markets and remoteness of the deposits) revived. Talc has also been mined in the Kingston Mountain region, and cinders have been quarried from the Cinder Cones and Lava Beds (Aiken Mine) areas southeast of Baker. Rare earth minerals have been mined on a large scale in the Mountain Pass area southeast of Clark Mountain. Periodic gold excitement has resulted in reactivation of gold mining operations in the eastern Mojave, including the Vanderbilt Mine in 1968 and the Bagdad-Chase Mine south of Ludlow during the early 1970s.

RANCHING/HOMESTEADING

Throughout the eastern California desert region, little oases with rich pockets of ground could become for a time more profitable bonanzas than most of the surrounding mineral lands. These isolated patches of fertile soil and perennial springs could produce crops of vegetables, fruit, and hay or fatten a herd of beef cattle, providing quick fortunes for the homesteader or rancher as long as the neighboring mining camps boomed. Although most ranchers held 160-acre homestead claims, they were usually able to irrigate only a fraction of that, while their stock ranged free for miles beyond. The proximity of ranches and mining camps determined the profitability of both, but ultimately it was the size of the ore pocket that limited the size of the salable crop, so as the mines went from boom to bust, so did the ranches.

The natural fecundity of watered land in the NEMO planning area had long been demonstrated by Native Americans, who raised crops of corn, beans, melons, and squash around some of the springs and seeps.

Miners who established the Rock Spring Mining District in 1863 probably were likely the first to maintain cattle and horses for extended periods in the east Mojave. Military garrisons and mining settlements in the region would continue to provide a market for fresh milk, meat, vegetables, and fruits.

The Rock Springs Land and Cattle Company (RSLCC) was incorporated in 1894, consolidating the earliest ranches in and near the present Mojave National Preserve (the Kessler Springs Ranch was the first, dating from the 1870s), and during subsequent years it extended its cattle operations over much of the eastern Mojave and into southern Nevada. The company, headquartered in the present national preserve, spent large sums to establish claims for exclusive use and improvement of the area's water sources. By 1920 the ranch would have nearly 10,000 head of cattle on its more than 1,000,000-acres. The ranch remained the dominant force in the cattle industry in the east Mojave until 1927, when one of its corporate members died and the company interests were subdivided. From 1927 until 1988, the OX Cattle Company, headquartered in Lanfair Valley and a direct descendent of the RSLCC, was the largest ranch in the east Mojave, operating over only a fraction of the area controlled by its predecessor, while other parts of the former range were operated as smaller ranches such as the Gold Valley, Overson, Kessler Springs, Valley View, and Blair ranches.

Beginning about 1910, settlers established homesteads and attempted dryland farming in the east Mojave, taking advantage of a cycle of particularly wet years. Although homesteads were established in many places, including Barnwell, Crucero, Goffs, and Pinto Valley, the majority (some 200–250 patents) were centered in Lanfair Valley, named for Ernest L. Lanfair, a merchant from Searchlight, Nevada, who filed the valley's first claim. After marginal success in drilling wells in Lanfair Valley, the settlers were forced to haul water over the Mojave Road from Government Holes, the one remaining water source in public ownership. By the late 1910s, dry years had returned, and many homesteaders had left the area. After the abandonment of the railroad between Barnwell and Searchlight in 1923, most of the remaining settlers moved out.

Dunbar was a black settlement established in 1911, 1 mile north of the Lanfair townsite in Lanfair Valley by G. W. Harts and Howard Folke, and at its peak the community numbered approximately 20 households. Harts tried an experiment in cotton cultivation, and Dr. C. H. Duvall planned construction of a home and industrial school for orphans on 40 acres of donated land, but the settlement was short-lived, its post office closing in May 1914.

Many homes stood empty in the east Mojave at the beginning of the Depression. Driven by the economic downturn, people moved into some abandoned sites and managed to eke out a living, some trying to mine gold on an almost primitive scale. These proud people, unwilling to face the urban soup lines, quietly wrote a chapter in the history of the eastern California desert.

COMMUNICATION

The first transcontinental telephone line, in operation from New York to San Francisco by 1915, crossed the present national preserve, but traces of the line have disappeared. Examples of significant communication lines in the national preserve area include the

first powerline constructed from Hoover Dam to the Los Angeles area during the 1930s and an early telephone line that parallels the Santa Fe Railroad.

During the 1960s the American Telephone and Telegraph Corporation (AT&T) constructed an underground communications cable network throughout the United States. In the early 1980s the system was upgraded to accommodate current technological advances using Phillips technology; hence, it was renamed the P140 coaxial cable system. At the present time, AT&T, which owns and operates approximately 709 miles of the system between Mojave, California, and Socorro, New Mexico, is proposing to remove communications cable, marker posts, manholes, and repeater stations (incompatible with the company's current fiber optic network) from a 220-mile right-of-way that includes national preserve lands.

FEDERAL ADMINISTRATION

Until the 1930s the public lands in the national preserve area were administered by the General Land Office (GLO), established in 1812 as a bureau in the U.S. Treasury Department and later transferred to the Department of the Interior in 1849. In 1934 the Taylor Grazing Act provided for the segregation of up to 8,000,000 acres (later raised to 142,000,000 acres) for grazing purposes under the jurisdiction of the newly established Grazing Service (GS) in the Interior Department. The Bureau of Land Management was established in 1946, uniting the functions of the former GLO and GS. The bureau was given responsibility for administering and managing all public lands in the United States and Alaska, including its surface and subsurface resources.

MODERN MILITARY TRAINING

General George S. Patton selected much of the eastern Mojave and part of the Colorado Desert to train his troops for the North Africa campaigns during World War II. Although Patton left with his troops for North Africa in 1942 after less than a year's training, more than 1,000,000 men destined for many of the war's major battlefields were processed through the Desert Training Center, or the California-Arizona Maneuver Area (C-AMA) as it became known after its area was expanded to include lands east of the Colorado River. Headquartered at Camp Young near Indio, California, the C-AMA focused largely on lands south of the national preserve area. However, an important campsite was established in the southern portion of Piute Valley north of Arrowhead Junction at Camp Ibis (just east of the present national preserve), and a division-level encampment, known as Camp Clipper (also known as Camp Essex), was established at Goffs in June 1942 for 16,000 troops, including a segregated black division. Portions of Camp Clipper, which operated until June 1944, are in the national preserve, and the Clipper Mountains and Piute Valley on both sides of the California-Nevada border served as operating areas for the military training exercises.

Operation “Desert Strike,” one of the largest exercises ever conducted by the U.S. Strike Command, involved more than 100,000 active and reserve men from all branches of the armed forces during training exercises between May 17 and 31, 1964. This multitude of men, along with a proportionate quantity of machines, guns, aircraft, and supplies, swarmed across the present national preserve from east to west, slashing hundreds of miles of new roads indiscriminately through the desert and leaving hundreds of tons of supplies and debris scattered throughout the area.

Today, nearly one-sixth of the Mojave Desert lies within military bases and reservations. Two of the military bases that are closest to the national preserve area are the Fort Irwin National Training Center and the Marine Corps Air Ground Combat Center.

RECREATIONAL DEVELOPMENT/TOURISM

Recognition of the recreational and park values of the California desert was first undertaken during the pre-World War I years by such organizations as the Automobile Club of Southern California and the International Desert Protective Association, both of which encouraged their members to tour the desert and helped them do so with maps, sign programs, and lobbying campaigns for better roads. Since that time, the eastern California desert region has attracted an ever-increasing number of tourists interested in taking advantage of its recreational opportunities, including hunting, trapping, rockhounding, hiking, camping, and sightseeing.

During the 1870s, a public bathing establishment was built at Soda Springs, known as Soda Lake Station when it was a stage stop. In 1914 a religious group led by Pastor Charles T. Russell occupied Soda Springs, constructing five frame houses and attempting to mine gold in the nearby hills. In 1944 Curtis H. Springer arrived at Soda Springs and, finding it deserted, took possession of the land under a mining claim. He and his wife, Helen, developed the property into the “Zzyzx Mineral Springs and Health Resort,” which operated until 1974. With the exception of several modern structures, the site is much as the Springers left it. Transferred from the Bureau of Land Management to the National Park Service in 1994, the site is leased to the California Desert Studies Consortium of the California State University.

Mitchell Caverns, developed as a tourist attraction during the 1930s by Jack and Ida Mitchell, became a California state park during the mid-1950s. Today, the state of California administers the caverns and surrounding area as the Providence Mountains State Recreation Area.

CULTURAL LANDSCAPES

Many cultural landscapes exist in the Mojave National Preserve that are potentially eligible for listing on the National Register of Historic Places, but cultural landscape studies have not been undertaken to identify their character-defining elements.

Landscapes reflecting mining, ranching, railroading, and ethnographic activities can be seen throughout the preserve.

NATIONAL REGISTER OF HISTORIC PLACES

The historic Boulder Transmission Lines 1, 2, and 3 Archeological District (CA-SBR-7694H), located both in the national preserve and on adjacent BLM lands, was determined eligible for listing on the national register as an archeological (historic) district on February 16, 1994.

A national register nomination form has been prepared for the Kelso Depot.

National register nomination forms are being prepared for Soda Springs Historic District and Mojave Road.

The following ten historic sites in or near the national preserve have been designated California Historic Landmarks or California points of historic interest:

Fort Piute	Marl Springs
Lanfair	Zzyzx Springs
Camp Rock Spring	Kelso Depot
Barnwell	Fenner
Nantan	Vanderbilt.

MUSEUM COLLECTIONS

There are no existing collections maintained by the Preserve, but the National Park Service could anticipate acquisition of archeological artifact collections and historical collections relating to mining, ranching/homesteading, modern military exercises, and recreational development/tourism (for example) Soda Springs.

RELATIONSHIPS OF NATIVE AMERICAN CULTURES TO NEMO LANDS

For millennia, American Indian peoples lived within the planning area, using the resources and lands to sustain their lives and cultures. These lands have been and continue to be subject to active, often dramatic, and ever-changing natural forces that can alter water supplies, change vegetation zones, make new landforms from tectonic or volcanic events, and include cutting or filling geological processes. Climatic changes that have occurred since the end of the Ice Age have altered moisture in lakes and marshes, affected animal populations and plant life, and challenged humans to adapt. This area is characterized by a series of parallel, northward-draining trough-like valleys between north-south oriented mountain systems that form rain shadows, resulting in more evaporation than precipitation and general aridity. The basic necessities for human life of American Indian peoples are present – water and food, materials for tools, access to routes for traveling, special places for spiritual rites that continue today, and a sense of land association and place identity. These peoples' presence has resulted in a tangible heritage of cultural materials, remembered place names and associations, and attachments to the land from history to modern times.

Nonnative people describe lands as typical of the Great Basin geomorphological zone and of the Sonoran-Mojave Deserts in biological terms. From valley floors to mountain peaks, a series of environmental zones is described from lower elevation scrub plant communities, through Joshua Tree and pinyon-juniper woodlands, to higher elevations of mixed pine and pinyon woodlands. The valleys often contain dry lakes or playas. Transitional foothill zones are cut by drainage systems, forming seeps, springs, and active seasonal streams. To American Indian peoples now known as Mojave, Shoshone, Paiute, Serrano, Chemehuevi, and Kawaiisu, the lands were occupied and used in many ways, with flexible boundaries among these tribal groups. These peoples are differentiated by language, varied subsistence patterns, and self-identification. Specific historic geographical associations to NEMO lands and places are known from compilations of information used in Federal Indian Land Claims court cases during the 1950s and 1960s.

In general, tribal peoples historically occupied their lands in small, mobile social units of related families who traveled in regular patterns, establishing summer or winter camps in customary places with water supplies, often located at a border between scrub or woodland zones. Some localities contained richer and more dependable food resources than others, but the lands did not support large numbers of persons at any one location. Many plants yielded seed, nut, tuber, or fiber foods, prepared for consumption or for storage at convenient caches. Large or small land mammals were hunted or caught, birds such as doves or quail were snared, and reptiles were collected, but not all plants or fauna were sought. The diet for these native peoples was largely vegetarian, supplemented by mammals, reptiles, and insect sources. Certain places on the lands were and are today considered specially significant; for example, landforms named in oral accounts of travels by supernatural beings, "hot" springs that have curative purposes, petroglyph sites believed to be the products of the shamans' supernatural helpers, or topographic landmarks identified in complex chants known today as "bird songs." In essence, "oral maps" of

NEMO lands still exist today in ceremonial knowledge held by certain Mohave and Chemehuevi individuals. Other tribal members have documented descriptive names in Shoshone language for places of settlement, gathering camps, and other important locations in the study area.

In the past two centuries American Indian peoples inhabiting the NEMO area have changed their territorial ranges in reaction to European and later American direct and indirect pressures, as well as intertribal struggles. U.S. military presence increased at Camp Cady, east of Mojave National Preserve, at established posts in the Owens Valley and at Fort Mohave along the Colorado River in response to increasing American settlers, miners, and ranchers. This resulted in establishment of more concentrated reservations and communities by the early 20th century. Earlier movements were caused by groups of families moving toward growing towns, shifting populations from more traditional scattered patterns. For example, from the southern Nevada portion of Southern Paiute-held areas, people now known as Chemehuevi had moved toward the Colorado River valley early in the 19th century. Kawaiisu, Koso (also known as Panamint Shoshone) and Serrano peoples were jointly using terrain around the Granite and Providence Mountain ranges during the 19th century.

In the 1950 –1960s, Federal Indian Lands Claims cases involving Chemehuevi, Mojave, and Owens Valley Paiute tribes included documented occupation and use of many mountain ranges, valleys, and resources in the study area. Maps illustrating Chemehuevi use of the lands now in Mojave National Preserve were accepted by Mojave tribal officials as well. Individual members of the Mojave Tribe have family historical information on early 20th century land uses in or near national preserve lands. Today's tribal governments and communities historically associated with the study area are as follows:

- The Chemehuevi Indian Tribe Reservation was established by Presidential Executive Order in 1971 (30,600 acres). Federal recognition occurred in 1970. Economic support comes from land leases, retail businesses, tourism and recreation services, and gaming. Tribal enrollment is about 500 persons, 300 of whom reside on or near the Havasu Lake, California, developed area.
- Mohave Indian Tribe Reservation lands are in Arizona, California, and Nevada, but tribal offices and some residential areas are in Needles, California. In 1864 a reservation was established from a former military fort reserve and nearby traditional lands. Economic developments relating to gaming, tourism, recreation, and retail business with considerable agricultural land leases provide tribal and individual incomes. The tribe population is about 1,000, with about 500 people living on or near reservation lands.
- The Las Vegas Piute Tribe is composed of “Nuwuvi” people, called Paiute by others, who inhabited present-day southern Nevada from pre-European time to present. In 1911 a small parcel of trust land was established near the town of Las Vegas. Today, the tribe owns the original 16-acre area and a 3,800-acre area north of metropolitan Las

Vegas. The tribe numbers about 100 people who gain their economic support from tribal tourism enterprises, retail sales, and wage work.

- In San Bernardino County, the San Manuel Tribal Community is composed of historic Serrano peoples who occupied the mountainous areas in today's Riverside and San Bernardino counties, with their related neighbors, the various Cahuilla communities. The 660-acre reservation was established by Congress in 1893. The tribe is about 85 individuals residing on or near trust lands. Enterprises include a casino and a curation facility.

VISITOR USE, SERVICES, AND FACILITIES

Mojave National Preserve has long provided recreational opportunities for people from all over the world. Its nearness to major population centers such as Los Angeles and Las Vegas, combined with major interstate highways, gives residents the opportunity for relatively easy access to many parts of the desert. Most of the landscape is open, with broad vistas of relatively undeveloped land. The vastness of the landscape offers visitors an opportunity for seclusion and a sense of wilderness, even while in a vehicle. Early miners and ranchers developed roads that today offer visitors a chance to drive into many remote locations where informal camping has traditionally occurred. There are several major sand dune systems. Hikers play on and explore the Kelso Dunes. There are many cultural sites such as abandoned mining districts, which many people love to visit. The mountain ranges, such as the New York and Providence Mountains, offer a contrast to the dry hot valleys, attracting many people in summer with cooler temperatures and forested areas. Volcanic cinder cones, lava flows, exposed geology, and unique wildlife and vegetation are other elements that attract people. The land has many extremes and contrasts that people come to experience, such as the high summer temperatures. Most visitors come to the desert simply to see the outstanding scenery of this diverse landscape.

VISITATION

TABLE 6: ANNUAL VISITATION FOR REGIONAL RECREATION AREAS

	1985	1990	1995	1997
Death Valley NP	576,400	691,000	1,109,400	1,222,762
Joshua Tree NP	641, 200	1,022,400	1,235,700	1,242,773
	1985	1993	*May 1996 - Apr 1997	1997
Mojave NP	60,000 (est.)	250,000 (est.)	339,700	378,977

* Mojave NP traffic counters began operating in May 1996.

Most visitation to the preserve occurs between October and May. It is estimated that 72% of overnight visitation occurs this time. In July 1996, 12,842 vehicles entered the preserve, compared to 14,617 in March 1997. While the numbers are very close, relatively few people stay more than a few hours in the summer. Campground use statistics show a different picture of summer visitation. During July 1996 there were 35-user days, and during March 1997, there were 1,412. These numbers reflect use of all developed campgrounds. The 1997 visitor study revealed that 64% of the visitors were from California and 11% were from Nevada. Most people started from Las Vegas, Nevada or from Twentynine Palms or Barstow, California on the day of their visit to the preserve. There may also be a large number of visitors who are taking a scenic route between Joshua

Tree National Park and Death Valley. The most concentrated use periods are the first two or three weekends of the upland bird and deer seasons in October and November, and the Thanksgiving and Easter weekends. April had the highest visitation record of any month during 1996. Campground use has increased over the years; the Bureau of Land Management recorded 960 user-days during April 1991; while the National Park Service recorded 1,252 in 1996 and 1,500 in 1997. These numbers may reflect having campground hosts and different BLM and NPS collection processes.

Many residents of adjacent communities such as Needles, Laughlin and Bullhead City come to the higher elevations in the preserve during the summer to escape the heat and enjoy a change of scenery. Most visitation to the preserve occurs on weekends when residents of California, Arizona and Nevada arrive. Day time recreational use is expected to continue to increase as the populations of Clark County and Laughlin, Nevada, Bullhead City and Kingman, Arizona, Barstow and Needles, California continue to grow.

Traffic counters and field observations indicate that many people are using roads in the preserve as a route between Las Vegas and Twentynine Palms. Most use in the preserve is sightseeing and driving for recreation, but the diverse landscape offers many other forms of recreation including activities such as hunting, nature study, rock-climbing, mountain biking, exploring by 4WD vehicle, and hiking.

OUTDOOR RECREATION

Many opportunities for day hiking exist. There are two developed trails: one between Mid Hills and Hole-in-the-Wall campgrounds, and the second a two-mile roundtrip to Teutonia Peak from Cima Road. There are other hiking opportunities—an abandoned road in Caruthers Canyon leads to an old gold mine, Kelso Dunes, and a trail in Piute Canyon leads along sections of the original Mojave Road and into the wash and eventually ends at Piute Gorge. Several former roads now in wilderness areas are closed to vehicle use; such roads may offer opportunities for hiking into Cow Cove, Castle Peaks, and other areas.

The large network of dirt roads leads many visitors to explore the preserve by 4-wheel drive or other high-clearance vehicles. This road network provides opportunities for dispersed camping; Mid Hills and Hole-in-the-Wall campgrounds offer camping in developed areas. Deer hunting brings many people in the fall who also participate in dispersed camping, changing places of solitude into informal campgrounds. Driving the historic Mojave Road is a very popular activity and has even attracted international visitors. An estimated 2,000–3,000 vehicles a year travel this 4WD route to enjoy the scenery and visit the historic sites noted in the *Mojave Road Guide*. The use of the Mojave Road is expected to continue to increase in coming years.

Horseback riding occurs in the preserve at several locations. A group called the East Mojave Scenic Area Trail Riders has defined routes out of the Hole-in-the-Wall Corral that lead into Round, Pinto, Gold and Lanfair Valleys. Watson and Woods washes also serve as routes to Caruthers and Black Canyons. Trails often follow old roads or washes or go

cross-country. These routes are not marked by signs, so the experience of using them is an informal “adventure.” The amount of use is unknown.

The Bureau of Land Management contracted for a visitor survey of the East Mojave Scenic Area (now the Mojave National Preserve). The report of the survey, completed in 1990, indicates that visitors participated in the following activities:

TABLE 7: BLM VISITOR ACTIVITIES IN EAST MOJAVE (PRE-CDPA)

Visitor Activities (1990 - BLM Visitor Survey)	Participation Levels
Auto-touring/sightseeing	43%
Nature study/hiking	19%
Off-road vehicle use	14%
Camping in developed campgrounds	14%
Dispersed camping	10%
Hunting*	Not available

* Hunting was not included in the initial survey but is a significant visitor activity during the Fall upland bird and deer hunts.

TABLE 8: BLM VISITOR PROFILE FOR EAST MOJAVE

Visitor Profile (1990 BLM Visitor Survey)	Percentage/Age
First-time visitors	43%
Repeat visitors	57%
Traveled 100–200 miles to get to the preserve	35%
Traveled 210–500 miles to get to the preserve	40%
Came to view the scenery	72%
Average age	25-40 years
California residents	81.5%
Stayed 13–24 hours during visit	17.5%
Stayed 3–7 days during visit	25.5%
Stayed 1–2 days during visit	44%
Said the preserve was not their primary destination	11.2%
Said the preserve was their primary destination	84.1%

TABLE 9: MOJAVE NATIONAL PRESERVE VISITOR ACTIVITIES

Visitor Activities (1997 NPS Visitor Study)	Participation levels
Auto-touring/sightseeing	61%
Nature study/hiking	49%
Off road vehicle use	51%
Camping in developed campgrounds	22%
Day hike	41%
Visit ruins/historic sites	32%
Driving through only	28%
Dispersed camping	15%
Hunting*	Not available

* Hunting was not included in the initial survey but is a significant visitor activity during the Fall upland bird and deer hunts.

TABLE 10: MOJAVE NATIONAL PRESERVE VISITOR PROFILE

Visitor Profile (1997 NPS Visitor Study)	Percentage/Age
First time visitors	46%
Repeat visitors	54%
International visitors	7%
Visitors from California	69%
Visitors from Nevada	12%
Average age	36-55 years
Stayed less than 1 day	61%
Stayed 3–4 days	29%
Stayed 7 or more days	4%
Of those who stayed less than a day, (stayed only 1 hour)	10%
Of those who stayed less than a day, (stayed 2–4 hours)	52%
Visited Kelso Depot	66%
Visited Kelso Dunes	57%
Visited Hole-in-the-Wall campground	35%
Visited Mid Hills campground	25%
Visited Mitchell Caverns	22%
Traveled on Wildhorse Canyon road	19%
Traveled on Mojave Road	16%
Visited Caruthers Canyon	8%
Visited Zzyzx	4%

VISITOR INFORMATION CENTERS

The National Park Service uses commercial space adjacent to the Bun Boy Restaurant in Baker, California as a visitor information center. The Death Valley Natural History Association and Mojave National Preserve share support and material costs. Information is available about recreational activities in Death Valley National Park, Mojave National Preserve, and surrounding Bureau of Land Management recreation sites such as Dumont Dunes.

The preserve also operates a visitor contact center at Hole-in-the-Wall in a building constructed by the Bureau of Land Management. A small amphitheater and a picnic area are also available. This visitor contact center serves as a point for people camping in or visiting the area and provides overnight, short-term housing for one NPS staff member. Hole-in-the-Wall is staffed seasonally as public demand exists and staffing levels allow for someone to work here. Electricity is provided by a propane generator, but a solar electric system is being planned.

The preserve leases office space in Needles, California, for a visitor information center. This facility is staffed by an NPS interpreter who provides interpretive and recreational information. Lake Mead National Recreation Area also supports the Needles information center with staff and in other ways.

KELSO DEPOT

Construction of the depot was completed sometime between 1923 and 1924, after which rooms and a cafe served railroad workers for approximately 38 years as a railroad hotel, restaurant, and club for workers laying over between shifts. The café continued to operate until June 1985, when it was closed. The building remains an excellent and rare example of a mid-1920s Mission Revival style railroad station and employee housing of the Union Pacific railroad in California.

The depot stands as a remnant of the steam-powered locomotive era, when pusher engines were used to help trains get up over the steep Cima grade. The historical setting for the building continues with a minor amount of intrusions from modern structures within the area. The building has been nominated for the National Register of Historic Places. The National Park Service also completed a historic structure report in 1997 that records the historic details of structure and made recommendations for stabilization and renovation. This document provides extensive documentation on the depot.

The depot is located at the preserve's most used crossroad, where the 1997 average was 172 cars per day. Weekend traffic levels are estimated as being much higher but exact figures are not available. Train traffic on the Union Pacific tracks is also very active, causing frequent delays on the Kelbaker Road of 15 to 30 minutes and sometimes up to 1 hour. This is because the road crossing is in the middle of the railroad siding. Trains

must be separated into two parts at the road when they stop, necessitating a lengthy process to set individual brakes on each car. The trains are an attraction to visitors, but they also pose a threat to their safety. The site has easy access to electrical power but telephone lines are limited at this time. Water would be available through an agreement with the Union Pacific or by drilling a well. Solutions to telephone and water problems can be found. A sewer system would need to be constructed for the depot.

The depot is within a 100-year floodplain, according to a BLM study prepared in 1990. Errors have been found in the application of the study method, and the National Park Service is now conducting a floodplain study to determine the potential threat of flooding to the building. At this time the National Park Service believes that the need to protect, stabilize, and renovate the depot into a visitor center outweighs the potential threat of flooding. Mitigating measures such as armoring the dike north of the depot, rerouting the Kelbaker Road so as to fill in the gap in the dike that the road creates, or establishing an advanced warning system could reasonably address concerns for the protection of human life and government property.

CAMPGROUNDS

Mojave National Preserve has two developed campgrounds, Hole-in-the-Wall and Mid Hills. There is no fee to enter Mojave National Preserve, but a fee is charged at Hole-in-the-Wall and Mid Hills campgrounds for the use of an individual or group campground.

Hole-in-the-Wall contains 35 campsites, new restrooms, an RV dump station and a campground host site. It is in very good condition. All campsites are accessible to visitors with disabilities and are designed for access by large recreational vehicles. The water system is being redesigned to provide better service. There is also a group camping facility with a corral at Hole-in-the-Wall.

The Mid Hills campground contains 26 campsites. It was not designed for larger vehicles, but serves tent campers and those with small recreational vehicles. The Mid Hills water system is being replaced and new restrooms were installed in late 1997. Picnic tables and fire grates have also been upgraded.

An unknown number of traditionally used backcountry roadside campsites are in the preserve. Roadside camping is allowed at any previously disturbed campsites. The government has not made any improvements (such as trash containers or metal fire rings) to these sites.

COMMERCIAL SERVICES

At this time, the Cima Store is the only facility-based commercial operation in the preserve. The privately operated store on private land has a limited number of items on hand but continues to serve customers traveling on the Kelso-Cima Road. Permits for commercial

operations such as movie-making and guided recreational tours have been applied for and granted within the preserve. At this time, the number of permits applied for is relatively low.

Several commercial facilities outside the preserve offer lodging, food, and other items. The town of Baker has several motels, gas stations, restaurants, fast-food services, and markets. Small facilities at Halloran Summit and the Cima Road exits off Interstate 15 offer gasoline and related services. Primm, Nevada, about 15 miles from the preserve's north boundary, contains a major resort/casino. Nipton offers a small amount of lodging and a few camping spaces. Goffs has a small restaurant that is not always open for business, and Fenner has a gas station/market. Needles offers a broad range of services to visitors.

PROVIDENCE MOUNTAINS STATE RECREATION AREA

Within the boundaries of Mojave National Preserve is the Providence Mountains State Recreation Area. The prime attraction is Mitchell Caverns, where guided tours are offered. A developed campground with six campsites and RV camping on the lower parking lot receives an estimated 25,000 users per year. The caverns tour attracts an estimated 14,000 people each year. The total annual use of the state park in 1986 was estimated at 60,000 people.

SOCIOECONOMIC DESCRIPTION OF THE PLANNING AREA

Additional information on the socioeconomic environment is provided in a separate analysis entitled “Economic Impact Analysis: Northern and Eastern Mojave Planning Area” by Dean Runyan and Associates.

The planning area covers three California counties. Roughly 40% of the preserve is in San Bernardino, 59% in Inyo, and the rest is within Mono County. From a regional perspective there are relatively very few people living on private property within the planning area boundary, particularly when the large metropolitan cities of Los Angeles and Las Vegas are considered. Both of these large cities are within 150 miles of the planning area and make a large contribution to the pool of annual visitors. In a recent survey, 81% of all visitors to Mojave National Preserve were from California. About 35% drove 100–200 miles to arrive; 40% traveled between 210 and 500 miles. That would indicate that most visitors are from the Los Angeles or San Francisco areas. There is a great contrast between visitors to Death Valley and Mojave: only 32% of the total visitors to Death Valley are from California, and 69% are international visitors.

LOCAL AND REGIONAL COMMUNITIES

The 1990 Census Indicated the Following Community Populations:

Baker, California

Baker’s estimated current population is 550. Most other unincorporated communities within the planning area have populations of fewer than 50 people. Searchlight and Laughlin, Nevada, and Bullhead City, Arizona, are outside the planning area.

Needles, California and Kingman, Arizona

The city of Needles is in the eastern Mojave Desert on the banks of the Colorado Desert, 140 miles east of Barstow. The 1996 population of Needles was 5,750.

Over 75% of the communities in the northern desert of San Bernardino County are unincorporated. Per capita income is estimated at \$12,000. Most of the population in Inyo County lives along California Highway 395, where many residents are employed in services, retail, mining, and agriculture. An increasing amount of the economy is being driven by tourism. More than 98% of Inyo County land is governed by federal agencies. Because of limited private land, and large ownership of water rights by the Los Angeles Department of Water and Power, limited growth is expected. Most of San Bernardino County, which is in the planning area, is managed by federal agencies such as the Bureau of Land Management, National Park Service, and the military.

MOJAVE NATIONAL PRESERVE COMMUNITY

Mojave National Preserve has a population of seasonal and permanent residents who live in many parts of the preserve, such as Lanfair, Pinto and Round Valleys. An estimated 200 full-time residents now live in the preserve. Of those, 109 live in Round and Lanfair Valleys. An estimated 136 people stay on their properties during weekends in the Round and Lanfair valleys. Private property ownership breaks down into two parts, land owned by Catellus Corporation which owns approximately 6% of the total land base, and other private owners, who own 5% of all private land within the preserve. Most of the people living in the preserve on a full-time basis are retired or self-employed. An estimated 20–25 full-time residents are employed in ranching, mining, at Union Pacific Railroad, or at Castle Mountain Mine.

SOCIAL VALUES

During a meeting to gather information on social values the residents of the preserve expressed varying attitudes about their informal community. Most people live to obtain a sense of independence from government and its regulatory controls and freedom from urban crime and pollution. The residents love the land and the opportunity to experience the four seasons. They are concerned about the potential impacts on their land from increased visitation. Many residents would prefer that the National Park Service leave them alone to live their lives unhindered by regulations, yet some have voiced a desire to have the presence of rangers to help patrol and protect the land and offer emergency assistance when needed. Despite the desire for independence, there is a strong sense of community among the residents. Several residents voiced the strong sense of support that neighbors offer to each other. Living a great distance from stores and other services that are common in cities creates the situation where neighbors rely on each other for materials and labor to fix broken water pipes, doors and other items. Social events were described where several neighbors gather to eat, drink, and talk. Close friendships appear to exist between many of these people. Overall, the desire for privacy and independence exist, as do the social ties that make up a close-knit neighborhood and are not commonly found in many urban settings.

ROADS AND CIRCULATION

The NEMO planning area contains several highways that serve as major transportation corridors through the state. Intestates 40 and 15 function as major routes between Los Angeles and southern California and many states to the east. A sampling of I-40 traffic during 1995 indicated that trucks accounted for 19-31% of overall traffic and recreational vehicles, 4-6%. The rest were passenger vehicles. Interstate 15 also receives a heavy amount of truck traffic, but its percentage of overall traffic is not known. I-15 carries the highest daily traffic volumes of any highway in the planning area. I-15 traffic increases on weekends as residents of Los Angeles travel to Las Vegas and then return. Traffic accidents, snow on high passes, and other incidents can close sections of I-15, forcing traffic to be routed through Mojave National Preserve and back onto I-15. The rerouting of traffic through the preserve has resulted in additional accidents and other impacts, according to San Bernardino County officials.

Old Route 66 (National Trails Highway) runs through the south end of the planning area between Needles and Ludlow. The road is maintained by San Bernardino County. An increasing number of travelers have been attracted to this road because of the American culture and nostalgia attached to this highway. Movies such as *Bagdad Cafe* and other media have raised awareness to the point where even international visitors are driving the highway. Many cities and businesses along the highway are promoting Route 66 for the potential revenues from tourism. The highway has been nominated for the National Register of Historic Places (see "Cultural Resources" for more information).

Traffic has increased on San Bernardino County roads over the past years. The roads carry travelers north of Palm Springs, through Mojave National Preserve, onto I-15, then back again. It is assumed that most of these travelers are headed to Las Vegas for the weekend.

The following table shows traffic figures as recorded by the California Department of Transportation for 1995. Figures reflect the combined number of vehicles traveling in both directions.

TABLE 11: 1995 AVERAGE DAILY TRAFFIC LEVELS

State Highway	Peak Hour*	Peak Month	Annual Average
I-15, Cima Road interchange	4,200	32,000	29,000
I-40, Kelbaker road interchange	1,200	12,400	11,000
Route 127, San Bernardino/Inyo County line	110	660	550
Route 178, Between Junction 127 and State line	95	890	750
Route 190, Junction of Rte. 136 east of Owens Lake	110	950	550
Route 190, Death Valley Junction	120	860	680
Route 395, Coso Junction rest area	1,150	7,200	5,300

*Peak hour is the hour during which the heaviest volume of traffic occurs on a roadway.

ROADS

Mojave National Preserve has six main paved entryways: Kelbaker Road, Cima Road, and Ivanpah Road off of I-15 on the north side, Kelbaker Road and Essex Road off I-40, and Ivanpah Road off of the Goffs Road (half of the length of this road is unpaved) on the south side. All these roads generally lead visitors in a north-south orientation with Kelso as a common point for four of these roads. The roads are all suitable for standard sedans, are in good condition and currently maintained by San Bernardino County. Among these roads, the Kelbaker road between I-40, Kelso-Cima Road and Morning Star Mine Road receives the heaviest use. Most traffic occurs on weekends as many drivers use these roads to travel to and from Las Vegas and Palm Springs.

TABLE 12: JULY–DECEMBER 1996 TRAFFIC COUNT

Highway	Average Daily Traffic
Kelbaker Road, southbound off I-15	45
Cima Road, southbound off I-15	55
Ivanpah Road, southbound off Nipton Road	144
Kelbaker Road, northbound off I-40	167
Essex Road, northbound off I-40	20
Ivanpah Road, northbound off Goffs Road	18

Note: numbers represent incoming vehicles only.

A road inventory indicated that there are approximately 2,180 miles of roads within the preserve. Approximately 345 miles of roads were closed to mechanized use by congressional designation of wilderness in the 1994 California Desert Protection Act. Informal roads were created for access to utility corridors, ranching improvements, private property, mines, homesteading, favorite hunting or camping areas, viewpoints and for a variety of other reasons. When Congress created wilderness within the preserve through the CDPA, roads or routes within wilderness were closed to mechanized use except in the following cases: people with disabilities using wheelchairs suitable for use in indoor pedestrian areas, private property owners and ranchers who need to use roads in wilderness to get to their property, and individuals involved in mining operations. The National Park Service grants access by appropriate means and methods.

The National Park Service maintains approximately 20 miles of unpaved road, including the Wildhorse Canyon and Kelso Dunes roads and the road connecting Zzyzx to I-15. The preserve also has ungraded and four-wheel-drive roads. The National Park Service does not maintain any paved roads at this time. San Bernardino County maintains an estimated 255 miles of road in the preserve and Lanfair Valley, of which 176 miles is paved.

On March 21, 1997, AT&T Corporation released an environmental report proposing to remove its communication cable that extends through Mojave National Preserve and to New Mexico to the east. AT&T proposes to remove the cable and 21.6 miles of access corridor, five segments along the Cedar Canyon Road (8.2 miles), one segment along the Kelbaker road (11.1 miles) and one segment near Soda Lake (2.3 miles). If the plan was

approved, these access segments would be eliminated and rehabilitated to a predisturbance state.

TRAILS

Few surface water sources in the preserve are suitable to support extensive backpacking, but there are many opportunities for day hiking. There are two developed trails, one between the Mid Hills and Hole-in-the-Wall campgrounds, which is 8 miles one way. The second trail leads to Teutonia Peak from Cima Road and is 2 miles one way. Piute Canyon trail is an undeveloped trail. Abandoned roads offer hiking opportunities, such as a 1.5 mile one-way hike up Caruthers Canyon to an old gold mine.

Mountain bike use in the preserve is unknown at this time. Bicyclists have recorded their names in the Mojave Road register, indicating their use of this route. Mountain biking is the third fastest growing equipment-related outdoor activity in the country, as of 1995. Off-road ridership has increased nationally by 20% every year since 1990. In 1995, an estimated 2.5 million to 3 million of those riders were classified as avid trail cyclists.

ADMINISTRATIVE OPERATIONS AND FACILITIES

ADMINISTRATIVE FACILITIES

The headquarters for Mojave National Preserve currently occupies space leased in the Mercado Mall in Barstow, California. Other suites are available for leasing, but secured parking for government vehicle storage is limited. Commercial support services and housing are readily available in Barstow, Victorville, and surrounding communities. A small building was constructed in Baker in early 1998 for use as an office for interpretive, visitor protection, and maintenance staff. A mobile home in Kelso is used as a residence/office for a visitor protection ranger. A wildland fire control operation at Hole-in-the-Wall includes a dorm, office space, a vehicle storage building, and other storage buildings. Electricity is provided by a generator. The ranger station at Hole-in the-Wall is also used as a field office for NPS staff. A visitor information center in Needles is in a leased building. Needles provides a variety of housing options for employees.

EMPLOYEE HOUSING

Preserve employees find housing in many different ways. At headquarters in Barstow, employees obtain housing in the local communities. Preserve employees in Baker have the option of living in one of the five doublewide trailers once owned by the California Department of Transportation (CalTrans) or renting space in the community. Rentals are limited in Baker. The trailers, which are in an old Caltrans maintenance yard on BLM-managed federal land at the east end of town, are in fair to good condition. The preserve is upgrading them for occupation. The maintenance yard has plenty of open space to be used for vehicle and material storage but lacks buildings for office and work space.

Kelso has a number of doublewide trailers that the railroad uses to house employees. Not all of the trailers have been occupied, and the National Park Service was able to rent one of them for employee housing. The stability of this housing option is uncertain. The National Park Service also owns a home northeast of the Hole-in-the-Wall ranger station off Black Canyon Road. The home is in poor condition and would need major rehabilitation before it could be occupied, but the potential exists.

The Hole-in-the-Wall fire center dormitory, which is in fair to good condition, houses 12 employees. Current staffing plans call for 15 employees in 1998 and up to 20 employees in the future, which means the dormitory would be inadequate. Staff offices are also located in this building.

The preserve opened a visitor information center in Needles, California, in December 1997 and stationed one staff member there. Existing housing in the community meets employee needs.

MAINTENANCE

An office building was constructed in early 1998 in the maintenance section of the abandoned CalTrans yard in Baker. The yard has several small structures that are used for storage and office space, and covered parking. There is a fair amount of unused open space. Some maintenance work is also based out of the Hole-in-the-Wall fire center, where there are a few small storage buildings.

EDUCATION AND RESEARCH CENTERS

SODA SPRINGS

Soda Springs is a few miles south of I-15 off the Zzyzx exit. It is home to the Desert Studies Consortium, a part of the California State University system. The facility offers dormitory-like lodging and classroom space for researchers and students attending field classes and extended education courses. Solar, diesel, and wind power provide electricity to the buildings. The facility consists of a set of historic and modern buildings all located on NPS property. The historic buildings and site features have been nominated for the National Register of Historic Places as a historic district. There are 12 buildings, 3 sites, and 11 structures that have been identified as contributing elements to the historic setting. A total of 12 buildings/structures that have not been identified as contributing to the historic setting. All the historic buildings and a few others are NPS property.

The consortium has repaired and maintained most of the buildings and site features over the years to keep them in good condition. The site, structures, and buildings are managed through a cooperative agreement between the consortium and the National Park Service. A caretaker associated with the consortium lives at the facility. The consortium has provided the National Park Service with information on natural resources and opened the door for cooperative work in educating visitors and interpreting resources.

An unstaffed visitor information shade structure with restrooms off the entry to the education center is behind a gate to keep visitors from driving in the area. A path with interpretive signs leads from the shade structure and around the pond directly to the east. The shade structure has been evaluated by an architect, who determined a need for major repairs.

A fence and gate south of the facility keep most vehicles from the adjacent BLM Raptor off highway vehicle open area out of the facilities, but on occasion vehicles bypass the fence and come across the dry lake bed, which has been designated as wilderness.

GRANITE MOUNTAINS NATURAL RESERVE

The Granite Mountains Natural Reserve is part of the University of California (UC) natural reserve system and is dedicated to ecological research and education. The reserve serves as a classroom, laboratory, and ecosystem library for field studies in natural sciences. Every year, field classes and researchers come to the reserve. With the passage of the California Desert Protection Act, Congress designated 9,000 acres of the Mojave National Preserve as the Granite Mountains Natural Reserve. Within the 9,000 acres, approximately 2,500 acres are owned by the University of California. Most of UC facilities rest on UC property. The National Park Service has no jurisdiction over UC property but the two entities plan to enter into a cooperative agreement that will set the framework for a cooperative collaborative working relationship. Conflicts exist between the UC and members of the public who trespass on the land to climb the rock faces in the Granite Mountains.

LANDOWNERSHIP AND USE

(See appendix C: Land Protection Plan)

MINERALS

Mineral resources in the preserve range from metallic to nonmetallic, or industrial, minerals. Mines in the preserve have produced gold, silver, copper, iron, tin, lead, and tungsten. Industrial mineral production includes cinders, fluorite, gemstone, magnesite, marble, and sericite. The minerals produced in the preserve are most easily classified by the tonnage and grade available for exploitation.

Tin and tungsten deposits in the preserve are in low-grade deposits of limited tonnage. These metals are considered to have a very low or no potential for discovery of economic deposits. Additionally, the size and grade of any economic deposits would be insignificant in terms of the quantities of these metals produced and consumed on a regional or national basis. Several mines in the preserve have produced combinations of copper, lead and silver. All these deposits occur as vein or replacement types of limited size and moderate to low grade. While the total amounts of these metals produced seems significant, in the scope of regional and national production, the amounts are insignificant.

Iron deposits exist in the preserve, and the tonnage and grade was adequate for economic production at one time. The demand for iron ore in the West has diminished because of a restructuring of the steel production industry. The current supply of iron ore in the region exceeds demands for feed stock in cement production. Deposits in the preserve are small and of moderate grade (40-46% iron).

Gold has been produced from several mines in the preserve and occurs as vein or disseminated deposits. Most gold production since 1986 has been derived from two moderate size, low-grade, high-tonnage open-pit mines. Resources at these two open-pit mines are exhausted. Favorable geologic environments do exist for the discovery of other similar deposits, but these areas have already been explored and evaluated by various mining companies without favorable results. The lack of available unclaimed land and the regulatory constraints for exploration and development seem to preclude the discovery and development of any low-grade, high-tonnage open-pit gold mines in the preserve. Gold has been mined from vein type deposits in the preserve, but the known occurrences were of limited length, depth, and width. Deposits of this type have high development and production costs. The limited extent of known deposits in the preserve makes future economic exploitation of gold in vein type deposits in the preserve doubtful. The production potential of gold from claims in the preserve (290,000 total ounces inferred resources from the 1990 report "Minerals in the East Mojave National Scenic Area, California" by the U.S. Bureau of Mines is insignificant in the scope of national and international production and consumption.

Of the industrial minerals in the preserve, fluorite, magnesite and sericite have small recorded production. The deposits hosting these minerals are of limited size and grade. Deposits of these minerals are insignificant in the scope of national production and consumption. There are also known deposits of cinders and limestone in the preserve. These deposits are large, and the limestone is reported to be high quality suitable for chemical uses. Cinders have been produced from two deposits in the preserve, with most of the production used in the Las Vegas, Nevada, area and in Needles, California. Cinders are used for building block and landscape material. Limestone deposits within the preserve compete in the Los Angeles market, and there are a number of limestone deposits in production that are closer to the market. There also are other deposits of limestone available for development in the region. Many of these deposits are closer to the Los Angeles area and therefore hold a more favorable market position than deposits in the preserve. Transportation costs are a large factor in the marketability of industrial minerals, often more critical than quality or tonnage. Limestone deposits in the preserve have a favorable position because of nearness to transportation, quality, and deposit size, but they must compete in a highly volatile market.

Gemstone resources in the preserve are all classified as recreational in nature. The gemstones are sought by hobbyists or amateur collectors (individuals and clubs) rather than commercial development. None of the deposits exhibit the characteristics of significant size, uniqueness, or quality to hold a significant place in the gemstone market.

GRAZING/RANGELAND

Grazing has been a continuing activity in the northern and eastern Mojave Desert for well over 100 years. This section describes the transient grazing of the 1850s–1870s, early 20th century cattle ranching, and current conditions.

American exploring parties brought large numbers of animals into the East Mojave (desert) in the 1850s. After the Mojave Road became a wagon road in 1859, the passing of trains of animals and wagons over the road became a daily occurrence. ...There are definite records as early as 1859 of trains pausing for a day or two at a time to graze their animals on the relatively lush range lands on the Cima Dome and in Lanfair Valley.

...In the 1870s, immense herds of sheep and other stock were driven over the Mojave Road to Arizona and some on to New Mexico. ...During 1875 alone, more than thirty thousand sheep (and perhaps as many as fifty thousand) were crossed over the Colorado River into Arizona at Hardyville. (King and Casebier 1981)

Much of the desert had been heavily grazed at various times between 1900 and 1940. For example, in 1920 the Rock Springs Land and Cattle Company alone owned 9,233 cattle, where today fewer than 3,500 are authorized to graze (BLM 1988). Both the acreage and the intensity of livestock use on federal land in the California desert have declined during this century. This decline may be due to a decrease in the demand for beef, stricter controls by the land management agencies, more efficient and cost-effective methods of raising beef

at other locations, and a decrease in forage production. Also, the rapid expansion of feral burro populations since their protection under the Wild and Free-Roaming Horse and Burro Act of 1971 has caused intense conflicts over forage in some areas (BLM 1980).

Cattle-raising in the Mojave Desert was apparently never really seen as a growth industry. In 1929, Thompson stated: "The natural conditions in most of the region are unfavorable to raising cattle on the open range, and there seems to be little likelihood that the industry will grow. The principal difficulty is that the supply of natural feed is not sufficient to support the cattle. In the rainy season annual plants that spring up furnish feed, but these quickly die and in most of the region there is no feed for many months."

In the Mojave National Preserve livestock grazing is permitted on over 1.2 million acres on 10 allotments.

TABLE 13: GRAZING MANAGEMENT

Allotment Name and est. % of Allotment within Desert Tortoise Critical or Category 1 Habitat	Total Acreage of Allotment	Percent of Allotment within Mojave National Preserve (Acreage)	Total AUMs**	Percent of AUMs within Mojave National Preserve (AUMs)
Colton Hills (70%)	147,847	100%	2,877	100%
Gold Valley (0%)	16,190	100%	1,152	100%
Round Valley (0%)	653	100%	27	100%
Clark Mountain (2%)	88,312	20% (17,500)	1,872	20% (371)
Granite Mountains (10%)	276,125	95% (262,000)	4,716	95% (4,475)
Kessler Springs (70%)	252,172	85% (219,000)	8,016	87% (7,615)
Lanfair Valley (60%)	339,553	80% (272,400)	12,168	95% (11,560)
Valley View (70%)	281,802	92% (268,000)	8,485	95% (8,069)
Valley Wells (60%)	237,258	18% (43,600)	4,644	18% (853)
Piute Valley* (90%)	33,468	44% (14,700)	0	0
Total	1,673,380		43,957	
BLM TOTALS	411,490	25%	6,958	16%
MOJAVE TOTALS	1,261,890	75%	36,999	84%

* = Ephemeral grazing

** = An AUM is an Animal Unit Month, defined as the amount of forage required by an adult cow and calf (or an equivalent combination of other animals) for one month (BLM, 1984).